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RESPONSIBILITY

STUDY No. 1—See Page 355

KATHERINE BINGHAM

**Complete Self-Instructing Library
of Practical Photography**

VOLUME V
Photographic Printing
PART II
Copying, Enlarging, Lantern Slides



J. B. SCHRIEVER
Editor-in-Chief

Popular Edition

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WILLIAM
LEAH
VASSALL

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CHAPTER I.

Albumen Paper Process.

1. While the making of prints on albumen paper in the regular photographic studio is, practically speaking, a thing of the past, this paper being superseded by the ready sensitized product, of which there are many kinds, yet albumen paper, owing to its cheapness and softness of tone, is today used quite extensively in the large commercial studios and by large art publishers. It is also used to a certain extent for proof work by some of the leading studios in the big cities, especially where large proofs are to be made, as the cost of an albumen print is less than one-fourth that of the ready sensitized product.

2. At the present day ready sensitized products have not superseded the ever reliable albumen product because of superior results to be obtained, for with the albumen paper the most beautiful tones and clear detail can be produced from any average negative; besides this, prints made on albumen paper are absolutely permanent. The principal advantage of the ready sensitized product lies in their convenience of being always ready for use, thus saving time and labor, which is an important consideration for the average photographer. In the early days the photographer prepared his own raw stock, albumenizing and salting the paper ready for sensitizing. This he soon abandoned when he found an opportunity to purchase the paper already albumenized, so for more than thirty years the photographer has used the ready prepared albumen paper. This paper is chiefly prepared in Dresden, Germany, and can be purchased from importers and large dealers in photographic supplies. The albumen paper is furnished in sheets 18 x 22 inches in size, put up in packages of reams

and half reams, and can also be purchased in dozen-sheet packages.

3. The chief secret of the successful manipulation of albumen paper lies in the sensitizing, fuming and drying of the paper. All the other manipulations, such as printing, toning and fixing, are practically the same as the ready sensitized printing-out paper in general use today.

4. **Keeping the Albumen Paper.**—Albumen paper should be kept in a cool, dry cupboard, in its original package, and is best kept flat and not rolled, for when it is rolled it is much more difficult to float it evenly on the silver bath without bubbles being formed.

5. **Requirements for Sensitizing Albumen Paper.**—The requirements for sensitizing albumen paper are as follows: A nitrate of silver sensitizing bath; a sensitizing dish; a glass rod; a drying box and a fuming box.

6. Unless a very large amount of paper is consumed, the drying and fuming box may be combined, the one box answering for both purposes.

7. **Preparing the Sensitizing Bath.**—In small studios, or in cases where albumen paper is only used occasionally and for special purposes, one bath of about 60 ounces of solution is all that will be required. In large commercial studios, however, a large stock solution of silver bath, 60 grains strong, is usually prepared at a time, and from this stock solution two baths of different strength are made up ready for use, each bath being used on alternate days, and while the one bath is in use the other is set in the sun, which clears and purifies the bath, making it ready for use the following day.

8. **Preparing a Small Bath.**—As before stated, when albumen paper is not used exclusively and on a large scale, then there is no need for a stock solution and the bath may be prepared in a bottle, ready for use. Usually a 60-ounce bath is sufficient, and this is prepared as follows:

9. In a glass bottle containing 60 ounces of pure water, dissolve 6 ounces of nitrate of silver crystals. The crystals may be dissolved by shaking the bottle or by

stirring with a glass rod. When all is dissolved test with the hydrometer. The bath should test between 55° and 60° . If the amount of silver added does not bring the bath up to this test, add more silver. If the bath tests over 60° , dilute by adding pure water. For general purposes the bath works best when testing between 55° and 60° .

10. In large studios where large quantities of paper are consumed, a reserve stock of solution is usually prepared, using a 2-gallon glass bottle and filling about two-thirds full with pure water, and then dissolving sufficient nitrate of silver to make the bath about 60 grains to the ounce. From this stock solution, the baths in use are replenished and kept up to their normal bulk and strength.

11. Where a variety of negatives are to be printed from, some hard, some medium, others very soft, we usually provide two baths of different strength. The strong bath is used for sensitizing paper to be used on medium strength or very thin negatives, while the weaker bath is used for paper sensitized for hard negatives. The weak bath gives slow or deep printing, thus enabling high-lights to print with the shadows and thereby overcoming heavy bronzing of the densest shadows, which usually occurs when printing from hard, contrasty negatives. With thin, soft negatives, of equal strength throughout, the printing is quicker, and if the paper is weak in silver the deposit will be insufficient to hold up the image, with the result that the prints are weak and mealy looking. With the stronger bath, which makes the paper richer in silver, you have a heavier deposit, permitting of deeper printing, resulting in stronger prints; hence the object of the different strength baths.

12. **Neutralizing the Bath for Use.**—A silver bath for sensitizing paper should always be kept neutral or slightly alkaline, which is just the opposite for sensitizing plates. For the latter the bath must be acid. An acid printing bath will give poor, flat prints, while a slightly alkaline bath will give rich, strong prints. The bath when freshly prepared and tested with blue and red litmus paper, will usually be found to test slightly acid, the blue paper turning slightly

red. To neutralize it, or to make it slightly alkaline, as is required, add to this bath a few drops at a time of aqua ammonia, stirring the bath each time and testing with the red litmus paper. When the red litmus paper turns slightly blue it is in proper condition and ready for use.

13. **Sensitizing Bath Dish.**—The sensitizing bath dish used has a flat bottom and is usually made of papier-mache 20 x 24 inches in size, or large enough to receive a full-size sheet of albumen paper. These trays are also supplied in smaller sizes, known as half-sheet size trays; but, they are not so convenient as the paper must be cut in halves before sensitizing, and this not only requires more work, but also necessitates the extra handling of the paper, which sometimes is injurious.

14. **Glass Rod.**—The glass rod is a round tube about $\frac{5}{8}$ inches in diameter, being about 24 inches long and flat on both ends. This rod is laid over one end of the tray and attached fast on each end with rubber bands. The bands are slipped through screw-eyes screwed into the table, one on each side of the end of the dish and looped over each end of the rod. The object of the rod is to supply a smooth surface over which the paper may be drawn when taken from the bath, thus removing all surplus solution from the surface of the paper.

15. **Sensitizing the Paper.**—The sensitizing of the paper should be done in a room free from direct light, and the room should be perfectly clean and free from dust. It is a good plan, where the floor of the room is of rough boards, to sprinkle the floor lightly a half hour before you begin sensitizing the paper. A table from 6 to 8 feet in length should be provided. The sensitizing dish should be arranged in the center of the table. On the one side of the dish place your albumen paper; the other side reserve exclusively for clean blotters, which can be used continually for months.

16. To begin sensitizing, first filter the bath into the sensitizing tray. This can easily be done by suspending a large glass funnel over the bath dish. In the neck of the

funnel place some absorbent cotton. The cotton should have been previously dipped in pure water. Where a special funnel is used for this purpose only, the same cotton can remain in the funnel until it becomes charged with sediment and dirt; it will not need to be wet after the first time used.

17. A simple way of suspending the funnel, where no special rack is provided, is to take an ordinary studio head-rest and adjust the height so the ears of the stand hang over the bath dish at a height of about 10 inches. Place the funnel between the ears of the stand, which will hold it from tipping. Pour the silver solution into the funnel and filter sufficient of it to give you a bath which will fill the tray to a depth of at least half an inch.

18. **Skimming the Bath.**—Sometimes you will find a fine scum collected over the surface of the bath, even after filtering. Just before beginning to sensitize, float a sheet of tissue-paper over the bath. This will take on all the scum and your bath will be perfectly clean.

19. **Rubbing the Albumen Paper.**—Before floating the paper on the bath, first with a handful of absorbent cotton, rub the the cotton freely, but not heavily, over the surface of the sheet of albumen paper. Do not allow the fingers to touch the paper, as they will leave marks and lines on it. The rubbing of the cotton over the paper has an electrifying effect on the surface so that the albumen will take on the silver more evenly.

20. **Floating the Paper on the Bath.**—Care is necessary in floating the paper on the bath to avoid the formation of air-bubbles. Each air-bubble, unless destroyed as soon as it makes its appearance, will cause a white spot in the finished print. The air-bells on the sensitizing bath prevent that part of the paper underneath the air-bell from coming in contact with the silver bath; consequently, that spot is not sensitized and, of course, will not print, resulting in a white spot.

21. **Laying the Sheet on the Bath.**—Take a sheet of paper and after rubbing it with a piece of absorbent

cotton, as described above, catch the sheet at the two diagonal corners between the thumb and first fingers. Bring the two ends quite close together, slightly curving the paper; lower the end furthest from you into the silver bath, and continue gradually lowering the sheet until it is all on the bath. See Illustration No. 52, Vol. I.

22. **Searching for Air-Bells.**—After the paper has had a chance to settle nicely upon the bath, requiring but a few moments, catch the paper by one corner of the sheet, raise it to the center and examine. If there are any air-bells on the surface break them with the point of a tooth-pick or tuft of cotton. Lift all four corners and examine in like manner. After all air-bells have been removed, float the paper for the required length of time. In summer months, usually 60 seconds is sufficient; in winter, or in cold climates, from one and a half to two minutes will be required. With a weak bath the paper does not require as long silvering as with a strong bath—usually one-third more time is allowed for a strong bath—the average being from one to one and a half minutes.

23. **Removing the Paper from the Bath.**—When the sheet has been floated the required length of time, catch it by the two near corners, between the thumb and first finger of each hand, and draw it carefully over the glass rod and place, face side down, on a clean sheet of blotting paper. Cover with another sheet of blotting paper and gently rub with the hand. Next, prepare your second sheet for sensitizing, in the manner previously described, and while the second sheet is on the bath, remove the first sheet from the blotter and place in the drying box.

24. **Drying Paper.**—While the process of sensitizing may be done in subdued daylight, the drying of the paper must be done in a darkened room or closet. A very convenient drying box—suitable for drying 24 sheets—may be made as follows:

25. Build a square box 24 inches deep, 30 inches wide and 36 inches high, and for convenience build the box 18 inches from the floor. In the center of the inside

of the top of this box, and running across the 30-inch way, draw a line and insert along this line, one inch apart, screw hooks upon which to suspend the paper. On the front of the box have a large door 20 x 36 inches. In the bottom of the box a dozen or more $\frac{3}{4}$ -inch holes are bored to give ventilation. Fully a half hour before you are ready to dry the paper, place in the box a No. 2 burner oil-lamp and close the door. The heat from the lamp will heat the box to a sufficient temperature to dry the paper in 15 minutes.

26. Stretchers for Drying Paper.—The simplest form of stretchers can be made as follows: Provide yourself with strips of soft wood $\frac{1}{2}$ x $\frac{3}{4}$ inches, and 20 inches long. One inch from each end of the stick attach a wooden photo clip. In the center of the strip place a No. 3 screw-eye. When the paper is ready to dry, attach a pair of clips to the top and bottom of the sheet. This holds the paper from curling. Hang the paper, which is now attached to the clips, on the hook provided in the drying box.

27. Fuming the Paper.—After the paper is thoroughly dried, it is fumed with the fumes of ammonia. The fuming assists in giving brilliancy and richer results. It also tends to prevent early discoloration. The paper may be fumed in the regular drying box, unless a large amount of paper is required, when two boxes will need to be used, one for drying and the other for fuming, but ordinarily the one box will answer both purposes. When using the box for fuming, provide a false bottom of zinc, or even cardboard will answer. Punch this bottom full of holes, say $\frac{1}{4}$ inch in size. The holes may be made by driving an ordinary nail into the zinc or cardboard. Distribute over the bottom of the box six or eight wooden blocks about 3 inches high. Lay the false bottom on these blocks. Into two saucers pour an ounce of strong ammonia. Place one saucer near each end underneath the perforated bottom, and close the door. The perforated bottom will cause the ammonia fumes to be evenly distributed throughout the box. The fuming should continue for 30 minutes, when the ammonia

should be withdrawn and discarded, and the paper taken from the box and cut up into the size sheets required.

28. **Printing.**—After the paper has been dried, fumed and cut up into suitable sizes it is ready for printing, and you should proceed in exactly the same manner as you would with any other printing-out paper. The speed of printing is about the same as the modern printing-out paper and the prints must be protected from strong light during the different manipulations.

29. **Washing.**—Prints are washed in exactly the same manner as other printing-out papers. The washing must be thorough. When the albumen prints are first placed in the wash water some of them take on a rather pretty red color, others appear purple, and still others are a brick red or yellow. Therefore, for even toning it is very necessary that they be made all one color before toning. It is advisable to add a handful of salt to the third wash water, and to handle the prints over rapidly, separating them, by hand, so that they all receive full benefit of the salt bath. After the salt bath, wash in three changes of plain water when they are ready for toning.

30. **Toning.**—While the toning of albumen paper is practically the same as the toning of modern gelatin chloride printing-out papers, and the same toning bath may be employed, yet the following formulæ will give very good results.

31. **Gold Stock Solution.**—In a bottle of convenient size, place the contents of a 15-grain tube of gold chloride; add to this 15 drams of water. Neutralize this gold solution by adding a little fine ground chalk. This will be your gold stock solution, each dram of this solution containing one grain of gold.

32. **Acetate Gold Toning Bath.**—The following bath will be found a very simple and reliable one and will give uniform results; the tone generally produced with it is a brownish purple:

Sodium Acetate	75 grs.
Gold Chloride Solution	3 drs.
Water	30 ozs.

33. This bath may be used repeatedly; although it is advisable, when using a second time, to use half new and half old. The temperature of the toning bath should be about 65° Fahr.

34. **Sodium Carbonate Toning Bath.**—Another good bath for a dark brown color is the following:

Sodium Carbonate	45 grs.
Gold Chloride Solution	3 drs.
Water	30 ozs.

This bath must be made fresh for each toning and should be prepared about one hour before using.

35. **Chloride of Lime Bath.**—For a purplish black tone prepare the following:

Chloride of Lime	4 grs.
Gold Chloride Solution	3 drs.
Water	30 ozs.

To this must be added a tablespoonful of chalk. This will neutralize it.

36. If you will heat your water when preparing this bath it can be used as soon as cold. If, however, made up with cold water, it should be allowed to stand for one hour. This bath may be used repeatedly until exhausted, but from time to time a little gold and chloride of lime must be added.

37. **Phosphate Toning Bath.**—For warm purple tones we would recommend the following bath:

Gold Chloride Solution	1 dr.
Sodium Phosphate	20 grs.
Water	8 ozs.

38. This bath must be used as soon after preparation as possible, as it will not keep and can only be used for one toning.

39. **Toning the Prints.**—Place only a few prints in the bath at the start; constantly spray them and watch the toning. If the prints tone very slowly, requiring more than 10 minutes, strengthen the bath by adding gold, neutralizing in relative proportions. If the prints tone too rapidly, dilute with water. When the bath is working smoothly, then a larger number of prints may be toned at the same

time. As fast as the prints are toned, place them in a large tray of water to which a pinch of salt has been added. The salt will set the tone and prevent bleaching. After prints are toned give them one change of fresh water and fix them for about fifteen minutes in a plain hypo bath—hydrometer test 18° . Wash and mount in the usual manner.

General Notes.

40. **Keeping Silver Bath in Working Condition.**—There is considerable likelihood of the bath deteriorating, therefore, it requires frequent examining, or testing. The bath should be filtered back into the original bottle after using, and tested for strength, as each sheet of paper silvered takes up a certain amount of silver and thereby alters the condition and strength of the bath. As the bath becomes charged with organic matter, which may be liberated from the paper sensitized, it gradually turns to a dirty brownish color, and when in such a condition it is impossible to produce good results. This must be remedied at once, and it can only be done by removing the organic matter and strengthening the bath by the addition of silver.

41. The first step to take in clearing the bath is to expose it to strong daylight; better still, to sunlight for an entire day. The strong sunlight will cause the organic matter to precipitate to the bottom of the bottle. The clear solution must then be decanted. When using this method it is, of course, necessary to have two silver baths, although one can be made to do if you will sensitize all the paper that you will need for the day early in the morning and then immediately return the bath to the bottle and place in the sunlight. It is advisable, if possible, to have two baths. A more rapid way of removing this organic matter is to add a very small quantity of hydrochloric acid. After adding this the solution should be tested with blue litmus paper. If it shows an acid reaction sufficient carbonate of soda must be added to neutralize it.

42. Still another method, and the most practical and simple, being used by most photographers in winter, is to

add a little Kaolin (china clay). This will carry down the finely divided precipitate. You must be absolutely sure that the Kaolin is pure; if adulterated it is not only useless but injurious.

43. **Testing Strength of Silver Bath.**—In order to ascertain the strength of your silver bath you should test it with a hydrometer. The ordinary hydrometer is not always accurate, however, and should be first tested by placing in plain water. If the bulb sinks to zero, or 0, it is correct; if it sinks below or above it is just that much off from being accurate. A safe instrument is what is known as an argentometer. This instrument is not unlike the hydrometer and is used in taking the specific gravity of the solution. It is made in the form of a glass tube and has three compartments. The top one, which resembles a rod, contains an ivory scale, graduated downward, from zero to 100. The second compartment is an air chamber, while the third contains mercury. When you place your solution into your graduate, and then place your argentometer into it, should this sink to the Fig. 50, it would show that each ounce of solution contains 50 grains of silver. If the meter is in perfect condition it will float at a number exactly equal to the number of grains of silver contained in an ounce of water.

44. **Strengthening the Sensitizing Solution.**—The amount of nitrate of silver to be added to the bath if it proves too weak, or the extra amount of water to add if it is too strong, can be very easily calculated. First, ascertain the number of ounces of solution, and multiply this by the number of grains strength per ounce. For example: If the argentometer test shows a strength of 52 grains per ounce and you desire to strengthen it to 60 grains, and the total amount of solution is 20 ounces, multiply the number of ounces (20) by the number of grains (52), which gives 1040. In order that your bath tests 60 grains per ounce, you must have 1200 grains of silver in the 20 ounces of solution. Subtract 1040 from 1200; which is 160. This will be the number of grains which must be added.

45. **Preserving the Sensitized Paper.**—It is always advisable to use the paper as freshly sensitized as possible. The paper sensitized in the morning should be used that same day. In warm weather the paper will take on quite a yellow tint on the second day. At times, however, the morning may seem fair and a great deal of paper be prepared. By nine o'clock the sky becomes overcast and settles in for a rainy day. Fuming the paper will enhance its keeping quality, and it is advisable, under the above conditions, to fume it for a second time and then place it under pressure in a light-tight drawer.

46. **Caution.**—The photographer will find that the change of seasons may make it necessary for him to change the strength of the bath, and also necessitate going to some extra trouble in order to obtain brilliant prints, sensitizing the paper so that it will not print mealy and that there will be no tear drops.

47. The first change necessary will be in the fall of the year, when the weather is colder; then you must increase the strength of your silver bath and also float your paper longer. It may be necessary, in order to avoid these tear drops, to rub the paper more thoroughly with the cotton, just before you float the paper on the bath. This rubbing warms up the albumen and causes it to take up the silver bath more freely. If the prints are mealy, it is probably because your bath is becoming filled with organic matter or it has turned slightly acid. Carefully test your bath and, if necessary, give it a sun bath. This is fully explained under the heading "Keeping Bath in Working Condition," Paragraph 40.

48. In the spring of the year you will meet with the same difficulties. You should apply the same remedies, with the exception that in the warmer weather the strength of the bath may be slightly decreased, and the paper should not be floated quite so long.

Difficulties.—See Chapter III, Paragraphs 74–85.

CHAPTER II.

Plain Salted Paper Process.

49. **Introduction.**—The commercial photographic worker of today is not limited to any one particular method or brand of paper for printing. In fact, the variety of processes is so great that the needs of any photographer may be fulfilled both as to the resulting effect and to the expense. Much less trouble is experienced (by the beginner at least) by the use of the ready sensitized papers, and generally they will prove more satisfactory than those sensitized by the photographer himself. With a little practice, however, it is possible to coat any paper with a solution sensitive to light and to print on it when dried. The number of processes and methods which may be employed is without limit, yet all require a certain amount of practice and experience in order that uniform results be secured.

50. The plain salted paper was one of the first to be put into practical use, and also one of the simplest processes to manipulate. Owing to its slight cost this process is especially adapted to commercial work when either great numbers of prints are required, or especially large ones. The most important consideration, if the results are to be permanent, is the selection of the paper. The paper must be pure and free from foreign substances which would act upon the various chemicals used in coating the paper and in producing the finished print. It is necessary to first coat the paper with a sizing and salting solution, which will make the surface of the paper non-porous. In other words, prepare the paper so that the sensitizing solution will not penetrate into the paper itself, but remain on the surface, and also that it may combine chemically with it to give

tone and quality to the picture. After the paper has been sized and salted and allowed to dry, it is ready to be sensitized. After sensitizing it is again dried and is then ready for printing, toning and fixing in practically the same manner as any other printing-out paper.

51. Although any ordinary pure paper may be used, Whatman's hot pressed drawing paper will be found of excellent quality; yet, when obtainable the Saxe or Rives brand should be used. The paper should have a plain matt surface. Whatman's drawing paper is more desirable for large prints, as it is heavier and stiffer than either of the other brands.

52. **Object of Salting.**—If the raw paper stock is simply floated on the sensitizing or silver bath, dried and printed, the resulting picture will be flat and appear sunken, and when toned and fixed the image would almost entirely disappear. This is due to the fact that the sensitizing solution has penetrated into the paper, and but a very small portion of the silver salts have remained upon the surface to receive the direct action of the sunlight. It is, therefore, necessary that the paper be sized or coated with a solution which will keep the sensitizing bath from penetrating into the paper. In other words, the pores of the paper must be filled with some solution for two reasons: First, to keep the image on the surface of the paper; second, that it may combine chemically with the sensitizing solution and thus assist in giving quality and tone to the picture.

53. **Other Supports.**—This process may be applied to silk or any fabric, also to wood or leather. The methods employed are practically the same as those for manipulating paper.

54. **Preparing the Sizing and Salting Bath.**—Ready sized and salted paper may be purchased from photographic supply dealers, and when obtainable we recommend its purchase. The sizing consists of some alkaline chloride combined with a small quantity of gelatin, or arrow-root. The viscous substance covers the surface of the paper and keeps the salting from penetrating into its pores.

55. The following formula is a very effective sizing bath, and answers practically every purpose:

Crystallized Ammonium Chloride	130 grs.
Re-crystallized Sodium Carbonate	200 grs.
Citric Acid	60 grs.
Arrow-root	160 grs.
Water	20 ozs.

56. There will be practically no necessity for altering this formula, providing negatives from which you print are of good, even quality. There may be times, however, when it will be necessary to modify the solution. For instance, if you are desirous of securing softer results use about one-half the above amount of ammonium chloride; while if printing from flat negatives and you desire to produce more contrast, increase the amount of ammonium chloride to about double that called for in the above formula. In mixing the various chemicals the arrow-root should be first worked into a thin paste by adding to it a very small quantity of water (about 1 ounce); then add 15 ounces of water and heat it slowly to almost the boiling point, but never allow the solution to boil, as this will invariably cause air-bubbles to be formed. When the solution has become quite clear it should be allowed to cool.

57. In another small vessel place the three quantities of crystals and add the remainder of the water. Use cold water and allow these crystals to dissolve without agitation, for combining the sodium carbonate and citric acid causes the mixture to effervesce and if stirred it would overflow. When the arrow-root solution has cooled, pour the dissolved crystal solution into it. The combined salting and sizing solution is now ready for use.

58. Another good formula is as follows:

Ammonium Chloride	70 grs.
Sodium Citrate	100 grs.
Sodium Chloride	25 grs.
Gelatin	10 grs.
Distilled Water	10 ozs.

The gelatin should be washed in two or three changes of cold water and then allowed to dissolve in warm water, when the re-

maintaining components of the formula may be added. Filter the solution and use while warm. The paper to be salted should be floated on this solution for three minutes.

59. **Caution.**—All chemicals used for the sizing and salting must be absolutely pure. As ammonium chloride often comes in an impure state, special care must be exercised when purchasing it.

60. **Sizing the Paper.**—Pour the solution into a clean porcelain or flat rubber dish, and float the paper in exactly the same manner as described for floating albumen paper on the sensitized bath. Before sizing, however, hold the paper to the light so that you can read the water mark correctly. The side showing the water mark is the one which should be salted and sensitized. Lay the paper face down on a piece of clean, dry blotting paper, and on the back of the paper draw a pencil line from corner to corner, being careful, however, not to press down too hard, as this will be liable to injure the face of the paper. This pencil mark will enable you to recognize the unsalted side of the paper after it has been dried. If you do not intend to float the full size sheet of paper, cut to the size desired and then proceed with the salting.

61. The paper may be floated on the surface of the salting bath, or it may be fastened by means of pins on a clean, flat board and the solution carefully brushed over the paper with a camel's-hair brush or a swab of cotton flannel. When employing the latter method the greatest of care must be exercised that the solution be distributed very evenly, for if not done evenly the resulting print will invariably show irregular streaks. If the paper is to be floated on the salting bath, it should be perfectly flat and well dampened before attempting to float it, for if this precaution is not taken the paper will curl and give considerable trouble. The paper should remain in contact with the solution for two to three minutes. After the paper has been sized and salted it will keep almost indefinitely. You may, therefore, prepare a sufficient quantity to last for some time. The salting and sizing solution itself will not keep



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and should be discarded after having been once used. If the paper has a tendency to curl up at the edges, breathing on it will cause it to lay flat.

62. **Sensitizing.**—When you are ready to sensitize the paper, prepare the following sensitizing bath:

Distilled or Pure Water	10 ozs.
Citric Acid	240 grs.
Silver Nitrate	600 grs.

63. The printing quality of the paper or the solidity of the image is governed by the quantity of silver nitrate present—in other words, the number of grains of silver nitrate in one ounce of bath. If the silver bath is too strong, it coagulates the organic matter, or if too weak, it dissolves it. A weak solution of silver nitrate leaves less free silver on the surface of the paper, and therefore, will not give as rich or as strong an image as a properly proportioned bath. The solution should never test under 40 grains of silver to the ounce. The object of employing citric acid is to prolong the keeping quality of the paper. If not used the paper would darken spontaneously without exposure to the light.

64. Pour the solution into a clean, flat dish the size of the paper you wish to sensitize, and proceed in the same manner as directed for the sensitizing of albumen paper. After drying the paper, if you desire to keep it for a few days in a sensitized condition, fume it the same as you would the albumen paper and place it in a drawer away from the light.

65. **Printing.**—When you are ready to print, cut the paper into suitable sizes, and with a pencil carefully mark the back of each sheet, so as to indicate the side which is not sensitized. This will enable you to correctly judge the side of the paper which is sensitized. The sensitized side, of course, must come in contact with the negative. It is necessary to considerably over-print this paper as compared with other printing-out processes, for the image loses considerable strength when in the hypo (fixing) bath.

Prints on this paper will appear a beautiful purplish brown color, varying according to the nature of the sizing used.

66. **Washing.**—Wash the prints in the usual manner, but see that they are *thoroughly* washed so that the last tray of wash water will be free of all milky appearance. The more thoroughly the print is washed the richer and clearer and more brilliant will be the tone obtained.

67. **Toning.**—The plain salted paper may be toned in any of the printing-out paper toning baths. Very pretty sepia effects are produced by simply washing and fixing in hypo. The following formula is especially recommended:

68. **Toning Bath.**—

Borax100 grs.

Hot Water5 ozs.

Thoroughly dissolve, then add

Gold Chloride1 gr.

Water5 ozs.

69. As this bath will not keep well it should be used immediately after preparing. The length of time to tone depends on the color or tone you wish to produce. From six to ten minutes is an average length of time, but much depends on the methods employed in sizing and sensitizing.

70. **Fixing.**—When the print is properly fixed all sensitive silver salts which have not been acted upon by the light will have been removed. During the process of fixing, as well as toning, the prints must be protected from actinic light in order to avoid fogging, or deadening of the tones. It is a good plan to dissolve the hypo in warm water, for when this chemical is added to cold water, the temperature becomes lower as the hypo dissolves, and this would make the fixing bath too cold, which would retard the fixing. The proper temperature of the fixing bath is about 60 degrees Fahr.

71. **Formula for Fixing Bath.**—

Hypo3 ozs.

Warm Water20 ozs.

72. Test this bath with blue litmus paper. If the hypo is acid it will turn the litmus paper red. It is advisable to add a few grains of carbonate of soda, or a few

drops of liquid ammonia—a sufficient quantity of either to cause red litmus paper to change slightly blue. The prints should be fixed for about ten minutes, and it is very essential that both the fixing and final washing be extremely thorough, otherwise the prints may become yellow in a short time. Alum, or any other substance which tends to produce sulphurization, should *by no means* be used to remove the last traces of hypo. If there are any signs of bleaching while the prints are in the hypo bath, reduce the strength of the bath by adding a little water. After fixing, the prints may be washed and mounted in the usual manner.

73. **Glycerin Bath.**—It will be found advantageous, after having thoroughly washed the prints and before drying them, to immerse them in a 10% solution of glycerin and water, as this will render them more pliable and easy to mount.

Difficulties.—See Chapter III, Paragraphs 86–92.

CHAPTER III.

Part I.

Difficulties—Albumen Paper.

74. **White Spots.**—These are generally produced if bubbles of air are allowed to remain beneath the paper while floating. Raise the corner of the paper as soon as it lays flat on the bath, and remove these air-bells by touching them with a match or toothpick.

75. **Tear Drops.**—These are small blots of silver solution which adhere to the paper when each sheet is not blotted carefully before hanging up to dry. This may also occur if the paper is not rubbed with the cotton before floating, for if the paper should be very dry, tear drops will form. By rubbing over the surface before silvering, the friction has a tendency to electrify the surface so the solution acts evenly.

76. **Paper not Taking the Silver Solution.**—This is a certain sign that the paper is too dry and should be placed in a damp place for a few hours before silvering. Always keep the paper in a cool place.

77. **Paper After Sensitizing Discolors Quickly.**—This is due to the fact that the paper was floated too long.

78. **Prints Have a Dull and Sunken Appearance.**—This may also be caused by allowing the paper to float too long in the sensitizing bath.

79. **Shadows Bronzing Quickly.**—Where the shadows bronze quickly before the print is completely printed is the result of floating the paper too long, or using too strong a silver solution.

80. **Weak Prints.**—Weak prints are generally due to insufficient sensitizing, not allowing the paper to float long enough, or using too weak a bath.

81. **Paper Appearing Greasy.**—Insufficient sensitizing, or the silver bath too cold.

82. **Foxy-Reddish Tones.**—This is often caused by floating the paper too short a time in the sensitizing bath, and by insufficient fuming.

83. **Paper Curling while Floating.**—Either the paper is too dry or the albumen film is too tough. *Remedy:* If the paper curls, breathe on the parts that are curling up and they will lie down flat again. If much trouble of this kind is experienced, keep your albumen paper in a box containing a dampened sponge.

84. **Stains on Parts of the Sheet of Paper.**—This will occur if the paper is allowed to come in contact with any unclean substances. Dark stains on the back are caused by silver solution running over on the back.

85. **Small Dark Spots or Specks.**—This is mostly caused by small metallic pieces of dust imbedded in the paper. They can generally be removed with the sharp point of a knife.



Part II.

Difficulties—Plain Salted Paper.

86. **Prints Discoloring or Fading in Spots.**—This is due to the use of impure paper, or paper which is not free from chemicals which have a deteriorating effect on the coating.

87. **Print Flat or Sunken in Appearance.**—Paper insufficiently or unevenly sized. The paper should be kept in the sizing and salting bath not less than two minutes. If the salting bath is applied to the surface of the paper with a swab of cotton flannel, great care must be taken that the solution is evenly distributed; otherwise irregular streaks will show in the print.

88. **Paper Curling when Floating on Salting Bath.**—Caused by paper being too dry. It should be well dampened before salting.

89. **Paper Printing Weak.**—Too weak a solution of silver nitrate. Sensitizing bath should test 60 grains of silver to the ounce of water, and never less than 40 grains.

90. **Paper Darkening while Still Fresh and Before Use.**—Lack of citric acid in the sensitizing bath.

91. **Print Appears Weak after Fixing.**—Insufficient exposure. The paper must be considerably *over-exposed*, as the image weakens considerably in the fixing bath. Too strong a fixing bath will also cause the prints to bleach.

92. **Prints Turn Yellow after a Time.**—If the prints have not been properly fixed and very thoroughly washed, they are liable to turn yellow in a very short time.

CHAPTER IV.

Carbon Process.

Part I.

Introduction.

93. While yet the oldest of all printing processes in present use, the Carbon Process still remains one of the most popular. It has never yet been superseded for permanency and beauty of result, or actual simplicity and cheapness. Yet, with all its simplicity of manipulation, the carbon process requires most careful working and great cleanliness to insure perfect results. Without this care and attention to cleanliness the process is neither easy nor economical, for the least carelessness will lead to spoiled prints and the initial cheapness of material is at once wiped out.

94. Strictly speaking, the carbon process is purely mechanical. Neither the color nor the quality of the *finished* print is dependent upon the individual will of the worker, as is the case with most other printing processes. A carbon print is either good or bad, there is no half-way measure. But with no other printing process can the worker produce such exquisite range of tone, such registering on paper of all the gradations of the original negative, such depth of transparent shadows, such purity of high-lights.

95. The carbon process is based on the peculiar action of gelatin and certain other organic substances, when treated with an alkaline bichromate solution and dried in the dark. Gelatin alone is soluble in hot water, but gelatin treated as above will become insoluble when exposed to the light. A sheet of paper coated with bichromatized gela-

tin, dried in the dark and then placed under a negative will faintly register the image on its surface. The high-light portion of the image, being under the dense parts of the negative, will not be altered by the light, consequently will be soluble in hot water, while the half-tones and shadows of the print will be insoluble in varying degrees, according to the density of the deposit on the negative.

96. If pigments be added to the gelatin, they will remain on the paper according to the degree of solubility or insolubility of the gelatin, and in this way an image is formed showing every tone of light and dark as registered inversely on the negative. In the parts of the print unaffected by the light the pigment will be washed away with the dissolved gelatin.

97. For the purpose of giving greater variety, carbon paper is supplied in some thirty different colors, suitable for every kind of subject from portrait to sea views, for ordinary commercial work, or for reproductions of Old Masters. The colors most employed are engraving black, standard brown, red chalk (Bartolozzi), warm black, warm brown, sepia, marine-blue and sea-green.

98. Although the worker can prepare his own tissue, it is not satisfactory to do so, as it is a messy process, so we advise the purchase of the ready-made carbon tissue. As carbon tissue does not keep well in a sensitive state, it is not supplied in that condition. It comes in rolls 2½ feet by 12 feet, or in cut sizes, one dozen sheets to the package. The beginner is advised to buy the cut sheets at first, as they are easier to handle, and can also be bought in assorted colors.

99. Prepared tissue presents a black surface of pigment and gelatin coated on a heavy white paper stock, and has a tendency to roll more or less tightly according to the dampness or dryness of the atmosphere. When too dry or stale it becomes brittle; therefore it is not advisable to lay in a greater stock than can safely be used in a few weeks.

100. **Sensitizing Chemicals.**—Bichromate of potassium, bichromate of ammonium and bichromate of sodium are all used for sensitizing carbon tissue, the first named being most generally employed. It should be purchased as chemically pure as possible, the cheaper or commercial brands being often too acid to react properly. It is usual to make the bath of 2% strength for summer use and from 3 to 5% strength for winter use. Various other chemicals are frequently employed to give greater sensitiveness or increased contrasts, and for summer use or in hot climates the addition of alum, salicylic acid or other astringents is recommended to harden or toughen the gelatin film.

101. **Drying of Tissue.**—Sensitized paper must be dried in a darkened room or closet which is entirely free from noxious fumes, dust, etc. The time it takes to dry has considerable influence on its sensitiveness; the quicker it dries the more sensitive it is. Sensitized in the regular way, it should dry in not less than five hours, or more than eight. A recently introduced "spirit sensitizer" is applied by brushing it over the surface of the tissue, and then the paper dries in ten to twenty minutes. This is a great convenience to the worker who has to get out his prints rapidly. (See Chapter XII, page 111.)

102. **Theory of Process.**—When sensitized carbon tissue is placed under a negative in the printing-frame and exposed to the action of light, those portions of the tissue which receive light are altered and rendered insoluble in water, in inverse ratio to the amount of light they receive. The highest points of light—those under the densest parts of the negative—barely receive any light; consequently the gelatin film is almost wholly soluble. On the other hand, the portions of the print under the clear glass parts of the negative—the shadows—receiving the full strength of the light, will become almost totally insoluble. Between these two extremes the insolubility of the tissue will depend entirely upon the range of gradation and the density of the various parts of the negative.

103. The light strikes through the tissue to varying

depths, according to the varying densities of the negative. If a cross section of the print could be shown enlarged, it would be seen that the layers of gelatin which have become insoluble are of varying depths, looking like the cross section of a mountainous country, showing hills and depressions.

104. As all parts of the tissue are slightly exposed to the action of the light when under a negative, it follows that there will be a layer of insoluble gelatin on top of the print immediately under the negative film. Were this print now placed in water, the image could not be developed but the soluble parts of the tissue underneath the top layer would dissolve out, leaving the top layer without any support, with the result that there would be no print. The picture, therefore, is really underneath the top layer of tissue, not on the surface as with other papers.

105. To reach the picture so that it may be developed out, some means must be employed of supporting the top of the tissue—the insoluble part—while the lower or original paper support is withdrawn, thus exposing the pigment, the superfluous parts of which may then be washed away leaving the print itself intact.

106. This is effected by what is termed “*single transfer*.” A piece of gelatinized paper is squeegeed to the surface of the exposed tissue while under water. The paper backing of the tissue is then removed, leaving the pigmented gelatin adhering to the surface of the second sheet of paper. The picture is not yet visible, but on subjecting the tissue to the action of hot water, the soluble parts of the gelatin and pigment are carried away, leaving the print, which, of course, is now *reversed*; *i. e.*, presents a picture such as you see of yourself in a looking glass.

107. A reversed picture is of little value for architectural and record work, but would be immaterial in pictorial or landscape work. Therefore, this single transfer picture is frequently used by amateurs and others who desire pictures for exhibition purposes or where a reversal of the image is of no importance.

108. For all record work, or where an inversion of the image would be a detriment, however, the single transfer picture must be again reversed before it can be made use of. This, in turn, is accomplished by squeegeeing, under water, the finished and dried print, which is on the temporary support, to a third support, which can be specially prepared and of almost any nature. The third, or final, support as it is termed, has greater adhesive action on the tissue than the second or temporary support, and this second support—usually paper or celluloid—can be removed, leaving the finished picture right side to on the final support. This method is called “*double transfer*” and presents certain difficulties which are all thoroughly explained in the following instruction.

109. With a large choice of color, and with the possibility of attaching the tissue to almost any kind of support—paper, celluloid, Japanese tissue, metal, wood, silk, etc.—a great variety of results can be obtained. Prepared transfer papers in all varieties and tints can be purchased or the worker can prepare his own supports as described herein.

110. **Permanency.**—Assuming that the pigments selected by the manufacturers are chemically pure, the carbon print is absolutely permanent, as far as any print on paper can be permanent. The simplicity of the operations and the absence of any chemical in the finished print also tend to permanency of the result.

111. Control of the print is obtained by the use of this or that color of pigment and by varying the strength of the sensitizing bath. Contrasts can be reduced by transferring the print to cream colored, rough surfaced paper, etc.

112. Pictures on carbon tissue can be transferred to china, watch cases or dials, etc., affording great possibilities for decorative effects.

113. **Poison—Caution.**—Where one is subject to chemical poisoning, great care should be exercised in the use of bichromate of potassium solutions. This is a poison-

ous salt and acts as a strong irritant when it gets under the skin. To avoid possible poisoning through the skin it is always advisable for the worker to wear a pair of rubber gloves or, at least, rubber finger stalls, when sensitizing the tissue. The bottles containing the bichromate solutions, too, should be marked "poison," to avoid accidents.

114. **Selecting Colors of Tissue for Special Subjects.**—Carbon printing is extremely fascinating work. While the process may sound lengthy, it is in reality very simple. Tissue, chemicals and the necessary apparatus do not call for any great outlay of money and the results of a carefully made carbon print are unequalled by any other process.

115. Many of the little snap-shots which look simple and uninteresting on either developing or printing-out paper, reveal new and unexpected beauties when printed in carbon.

116. With the wide choice of colors, it is an easy matter to select one which will best suit the character of the picture or subject. For instance, pictures in which the composition depends on broad effects rather than fine detail, such as *sunsets*, would look well in red chalk.

117. *Wave studies* will take on a new aspect in marine-blue, or, better still, sea-green.

118. Sea-green often suits "*against the light*" subjects, where strong light and shadows are contrasted.

119. Sepias or warm browns are specially suited to *woodland scenes*.

120. In *portraits*, young faces often look well printed in a circle of light sepia or portrait purple, while strong faces, especially of old men and women, come out well in dark sepia or warm blacks.

121. *Snow scenes* are well interpreted in light blue, green, or even black, tones.

122. *Old houses* and *quaint cottages* appear well in sepias, while more severe *architectural views*, in which fine detail is required, should be printed in black and brown.

123. On the other hand, carbon tissue is not suitable

for *panoramic views* in which there is an over-abundance of fine detail, or for *scientific work, machinery, etc.*

124. Printing-out paper or bromide is the best for *commercial use*; carbon for pictorial or portrait work. No rule, however, is without its exceptions and the skilled worker will, of course, be able to use carbon for any and all purposes.

CHAPTER V.

Carbon Process.

Part II.

Brief General Instruction.—Single Transfer.

125. In the previous chapter we gave a brief summary of what the carbon process really is and what it accomplishes. In this chapter the practical working of carbon tissue will be described fully, without, however, any reasons being given as to the use of this or that chemical, or any explanations which might tend to confuse the beginner.

126. We will commence with the single transfer process, which reverses the image, but is simpler in operation than the double transfer method. The reversal is a minor point in *pictorial work*, but is, of course, useless for *record work*.

127. An impression which is quite prevalent among photographic workers, is that the process requires a liberal outlay for apparatus and materials with which to work, but there is really no doubt that it is based on a total misconception, as the outfit required is simple and inexpensive and some of the equipment necessary may be already in your possession. The following outfit is intended for prints 5 x 7 and under; larger prints will require larger trays, tissue, etc.:

128. **Outfit Required.**—There will be required one zinc or porcelain tray, 8 x 10, or larger, for sensitizing; two galvanized iron trays, 8 x 10, for developing; one ordinary tray—any size—for soaking the carbon supports; one rubber tray for alum fixing; one sheet of rubber cloth about 14 x 17 inches (not oil-cloth); one flat squeegee; one-half dozen wood photo clips; one actinometer; one large glass plate, on which to lay the tissue while squeegeeing out the

surplus sensitizer; one broad rubber-bound camel's-hair brush; one thermometer; two dozen carbon tissues; six white matt celluloid supports; one package of assorted paper supports; twelve plain blotters, 5 x 8 inches; 6 ounces of bichromate of potash; one pound of powdered alum; one bottle of waxing solution; one bottle of collodion. Should smaller size tissues than the sizes included be desired in this outfit, they can be cut from the larger sheets to the size required. Half sheets are recommended for experimenting. For the final support with your first work, celluloid is also recommended, as this support can be used over again should you fail in the first attempt; while a paper support is ruined after once being used.

129. Carbon tissue is sold in rolls and in cut sheets of different colors. A package of cut pieces, of the size you purpose to work, should be purchased, the best color for the beginner being engraving black. The transfer paper first used should be smooth, providing celluloid is not employed. The squeegee required is a flat one, not a roller. It is well to get a fairly long one, as then it can be used for prints of any size.

130. **Preparation.**—The evening before making prints, proceed with preparations for sensitizing the tissue. This is quite a simple operation. (**Formula No. 1.**) One ounce potassium bichromate should be dissolved in 7 or 8 ounces of hot water, and then diluted to make 10 ounces. This is the stock solution and will keep in an ordinary corked bottle for any length of time without deterioration. For use, dilute one ounce of stock solution with water to make 5 ounces altogether. The diluted solution also keeps well, and there is no reason why the weaker solution should not be made up at once, if you have a bottle large enough to hold the 50 ounces of liquid, which will be the amount of the solution made up with one ounce of bichromate.

131. To keep down the list of necessary materials as much as possible, we have described a sensitizing bath consisting of a plain solution of potassium bichromate. Many experienced carbon workers use nothing else. Further on

in this instruction are given formulæ for other baths, but it is recommended that the beginner use the plain bichromate bath.

132. **Alum Solution.**—Prepare the alum solution by dissolving one ounce of potash alum in 30 ounces of hot water. Cold water may be used, but hot water dissolves the alum more rapidly. This alum solution keeps indefinitely.

133. **Drying-Room.**—The chemicals and paper used for working carbon must be kept in a cool and absolutely dry place. The room in which paper is sensitized must be free from dust. A hard-wood floor is preferable. When the work is done in the home, instead of a studio, and where there are soft-wood floors and no carpets on the floor, we would advise sprinkling the floor an hour before sensitizing the paper. Do this to settle all dust. If the floor is carpeted there is less likelihood of dust being raised during the sensitizing. You cannot be too careful about dust when sensitizing carbon tissue; therefore, a natural wood floor is preferable. A good, clean bathroom is alright. In addition to this room there must be a closet, perfectly dry, free from dust and absolutely light-tight. This closet is used as a drying-room. If such a closet cannot be secured, then an ordinary dry-goods box, made light-tight by being covered with some opaque material, can be substituted. The box can be made into a little cupboard, not smaller than 2 x 3 feet, and one of the boards should have hinges attached to it to be used as a door, but *be sure that the box is light-tight.*

134. After preparing the room for sensitizing and drying the tissue, proceed to make up the sensitizing bath. For experimental purposes the small bath previously mentioned will be sufficient; but, if much carbon work is to be done, it is well to make the bath in large quantities, using sufficient of the solution for sensitizing the tissue you expect to use at once. As the chemical is inexpensive, discard the bath after using and thus avoid possible failures.

135. **Formula (No. 2) for Large Bath.**—Prepare the sensitizing solution in a large jar or stone jug, making up

as follows: In the summer months, or in warm climates, dissolve in 100 ounces of water, $2\frac{1}{2}$ ounces bichromate of potash; in winter increase this strength to 3 or 4 ounces of potash to 100 ounces of water.

136. **Sensitizing the Tissue.**—A zinc or porcelain tray somewhat larger than the paper to be prepared should be employed for sensitizing. Of this sensitizing solution filter into the tray a sufficient quantity to give a depth of at least one inch. This done, the bath is ready for sensitizing the paper. As the different colors of carbon tissue cannot be judged by the appearance of the surface, always mark the color of the tissue on one corner of the back, with a lead pencil. Do this immediately upon taking the paper from the package. The black side of the tissue is the face side. After dusting the face and back of the sheet of carbon tissue with a camel's-hair brush, immerse it in the sensitizing bath, face side down, and with the camel's-hair brush wet with solution.

137. Carefully sweep the air-bells away from the back and the front of the tissue, watching and moving the tissue constantly to see that none remain. It is equally as essential that no air-bells appear on the back as on the face of this tissue. It is well, therefore, to immerse the print face side down for one minute, keeping the air-bells off the back and occasionally examining the face. If air-bells appear, remove them by touching with the camel's-hair brush, saturated with the sensitizing solution. After one minute elapses turn the sheet over, film side up. In each instance dip the print under the solution, sliding under instead of laying it flat on the solution. In this way the entire print is immersed and the air does not strike the surface at any time. While sensitizing the tissue, the fingers will have to be brought in contact with the bichromate which has a poisonous action on some people. It is, therefore, advisable to wear rubber gloves, or rubber finger stalls during the operation of sensitizing.

138. Allow the print to remain in the solution for about $2\frac{1}{2}$ minutes, one minute with the film side down,

$\frac{1}{2}$ minute with the film side up—the last minute with the film side down. If desired, immerse several sheets at a time, but for the beginner it is not advised. When the $2\frac{1}{2}$ minutes have expired, lift the tissue slowly and carefully out of the bath, by taking hold of two opposite corners with the thumb and first finger. Place the tissue, face side down, on the sheet of glass, which has been previously cleansed with clear water. Place over the tissue the sheet of rubber cloth; then with the squeegee, which should be long enough to reach entirely across the sheet, carefully, and with even pressure, sweep the surplus solution from the back of the paper, leaving the surface dry. Now, remove the rubber cloth and lift the sheet of tissue from the squeegee plate by catching hold of the corner. Attach photo clips to two corners, and having previously stretched a line in your drying-room, hang the clips on the line. You can continue to sensitize as many sheets as you desire, but we do not advise sensitizing more than a few sheets for the first trial. After all are sensitized place in the drying-room and allow them to remain there for at least twelve hours. It is always well to sensitize the tissue a day before you expect to use it. A good plan would be to sensitize the tissue in the evening and allow it to dry over night. The carbon tissue will work better when a day old.

139. **Drying Tissue.**—If your drying-room is connected with a room supplied with some way of heating it, it would be well to allow the door of this room to remain open for several hours before using, so that the drying-room may become thoroughly dry and warm. As a hot room will cause tear drops by softening the gelatin film, be careful to select a room that is thoroughly dry, but not too hot—one connected with a room that can be heated is better. The carbon tissues, *before* sensitizing, will keep well for two months.

140. The sensitized carbon paper is about twice as sensitive as silver paper, and will remain in good condition for from three days to one week, if kept from the light. After the paper is thoroughly dry, place it in an ordinary

plate box, one sheet laying on the other. After all are placed in the box, weight down with a piece of heavy glass, in order to hold them flat, as this paper is much easier to handle when perfectly flat. The paper is now ready for printing.

141. **Masking the Negative.**—Your next step will be to prepare the negative to receive the carbon tissue. Cut out a mask of black opaque paper, such as is used in wrapping dry plates, or yellow post-office paper, the latter being preferable. The mask should leave a margin around a 5×7 plate of at least $\frac{1}{2}$ inch. Paste the mask on the film side, making an opening 4×6 inches; smaller plates in proportion. This mask on the negative will supply to the carbon tissue what is known as the *safe edge*, which is absolutely necessary when making all carbon prints.

142. Lantern slide binding, or passe-partout tape, cut into strips about a quarter of an inch wide, may be placed around the negative. There is but one caution necessary, and that is against allowing the paper to overlap at the corners. If it does it may result in the breaking of the negative. The two strips should be neatly fitted together. A brush charged with India ink or other black paint or black varnish may be applied around the edge in a similar manner.

143. Another method favored by some carbon workers is to take a piece of clean glass, the same size as the negative, putting the "safe edge" on that. This glass is then placed in the printing-frame, so that the "safe edge" on it is in contact with the glass side of the negative when this is put into the frame. The advantage of this method is that one "safe edge" for each printing-frame in use will be sufficient, and it is, perhaps, the best plan of all.

144. **The Quality of Negatives.**—Different qualities of negatives require various depths of printing. The best negative for carbon prints is one that would make a good, snappy albumen print; hard negatives give contrasty results. A good negative is one quite thin and snappy, full of detail,



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and clear in the high-lights. Such a negative will yield most beautiful results. Flat negatives make flat prints, but few negatives are made exactly of the same quality; therefore, no two can be printed the same length of time. For this reason you must sort the negatives from which you expect to print, arrange them according to their different strengths and place them by themselves.

145. **Actinometer.**—As there is no outline visible until the tissue is developed, it is useless to examine the carbon tissue when placed upon the negative to print. You must, therefore, be guided entirely by what is known as the actinometer, which is an instrument or contrivance for measuring the printing quality of light, and in this instance is used for determining the exposure necessary for the carbon print. There are many of these instruments on the market, yet none are as good as the one you can make yourself. To make an actinometer, proceed as follows:

146. Provide yourself with a 5 x 7 clear glass; cover this glass full to the edge with one thickness of fine white tissue or onion skin. The difference between onion skin and tissue paper is merely the quality; the former is of finer grain than the latter. Attach a sheet of this onion skin to the entire plate, by pasting the upper and lower edges; then cut a second sheet the same width, but one inch shorter in length than the first one; add a third sheet one-half inch shorter than the second, and a fourth one-half inch shorter than the third, and so on until you have twelve steps, or twelve sheets, each one-half inch shorter than the other. Through the center of these sheets, beginning at the top, number each step or sheet from one to twelve, the numbers indicating the number of thicknesses of tissue paper over the glass. This constitutes your actinometer, and is the instrument by which to judge the density of the plate.

147. Hold the plate which is covered with the tissue, and is now an actinometer, up to the light in one hand, and in the other hold the negative from which you expect to print. Examine them carefully by looking through them to the light, and notice which one of these steps supplies

the same density as the highest light in the negative from which you expect to print. By the highest light in the portrait negative we mean the most dense portions of the face, which is generally on the forehead. This point of the light or density of the negative must be equal to the thickness of tissue on the actinometer.

148. **Proofing Negative.**—If this is hard for you to judge at first, place your actinometer in a printing-frame, and the negative from which you expect to print in a second printing-frame. Upon this negative place a piece of ordinary printing-out paper, and on the actinometer use a narrow strip of this same paper sufficient to cover the numbers, but not over one inch wide. After placing the strip on your actinometer, clamp the cover on the printing-frame. It is now ready for printing. As this strip of paper prints, it registers the numbers corresponding to the different depths of printing.

149. Place the actinometer, which is in one printing-frame, and the negative, which is in another frame, in the light to print at the same time. Examine the print on the negative from time to time, and when the high-lights or strongest portions of the negative are merely tinted—not fully printed (the drapery may be well outlined, but the high-lights must be only slightly tinted)—at once remove the actinometer from the light, as well as the frame containing the negative, and compare the two tints. The strip of paper on the actinometer will be printed in steps, one step darker than the other. Compare this proof from the actinometer with the print from the negative, and notice which number corresponds with the faint tint on the strongest high-light on the print from the negative. Note the number of this tint. This is your key and this is the number you must go by when printing your carbon tissue.

150. It is well to register a number corresponding to the actinometer upon the negative from which you are printing. This will save you testing the density of your negative each time you desire to print from this plate. All you will need to do when again printing from such a nega-

tive is to note the number written thereon and print accordingly. You are now ready to place the carbon tissue upon the negative you are to print from. Place the tissue in the printing-frame, backing it up with two thicknesses of dry blotting paper. This will bring the tissue in perfect contact with the negative. A printing-frame with good strong springs is necessary for carbon printing. Clamp the back onto your negative firmly. The placing of the carbon tissue on the negative must be done in a room that is free from direct light, as the tissue when dry is very sensitive. Usually a dark-room with a gas or electric light, or ordinary incandescent light, is the best to handle carbon tissues in.

151. **Printing.**—After loading your frame with the carbon tissue, again place another narrow strip of ordinary printing-out paper on your actinometer and clamp it firmly. Place both frames in the light to print. A good, strongly diffused light is best. It is not advisable to print in bright sunlight. Do not examine the frame containing the carbon tissue; judging from your former experience you should have learned, almost to the minute, how long it will require for this negative to print. Within a few minutes of the proper time examine your actinometer or the strip of paper placed in the frame containing the actinometer. Examine it closely, and if the step or number to which you have calculated it necessary to carry your print has not yet been tinted, immediately place it in the window and continue printing; examine it again in a short time, and continue doing so until you have secured the proper tint.

152. **Caution.**—It is advisable for your first experiments to withdraw the negative with the carbon tissue while you are examining the actinometer, as you are apt to over-judge the printing, for the negative containing the carbon tissue will continue to print while you are examining the strip of paper, and if you examine the paper quite frequently the carbon tissue will have gained upon you in time of exposure. When you have secured the proper number to print to, withdraw both frames, remove the carbon

tissue from the frame, and if you so desire you can place this sheet in a box in the dark-room and make a second print before you start to develop.

153. Temporary Actinometer.—If you do not care to go to the trouble of preparing an actinometer, select another negative similar in density and gradation to the one from which you intend making the carbon print, and use this second negative in place of the actinometer. Place the first negative with its “safe edge” in a printing-frame, and place a piece of sensitive tissue upon it and fasten the back of the frame in place. In another printing-frame place the second negative, and on it a piece of ordinary printing-out paper. As you cannot look at the carbon tissue while it is printing, the printing-out paper on the second negative will act as a guide for you to follow. A visible image will soon appear on the printing-out paper. Printing must be allowed to continue until there are signs of detail even in the highest lights of the guide print. It is impossible to say much more than this, but after a little experience you will be able to judge exactly how far to carry the guide or test print. It is advisable to develop this carbon print before proceeding to make a second one. The guide print should be taken in at the same time and placed in a dark place, until you see if the exposure was correct or not.

154. Preparing the Developing Bath.—Into one of the galvanized-iron trays pour hot water heated to about 80° Fahr. Prepare another tray ready for water that should be heated to 110° Fahr. In a third tray containing clear, cold water, place your support, whether paper or celluloid. Beginners are advised to use celluloid, for the reason that should they fail in the first attempt the celluloid can be used over again by washing off the surface. A white matt celluloid should be used.

155. Transferring the Print.—Into a tray of clear, cold water place as many sheets of celluloid as there are carbon sheets to be developed. In another tray of clear, cold water place the carbon tissue to soak. This operation should take place in subdued light—electric or gaslight is

good. Daylight can be employed when the curtains are drawn on the windows so as not to admit any strong light on the print, as the tissue is much more sensitive to light than ordinary printing-out paper. When placing your carbon tissue in the tray of cold water it will curl up at first, with the black side inward. You must keep it agitated, and with your camel's-hair brush remove the air-bells from the back of the print as well as the face. Allow this tissue to remain in the tray until it flattens out. This will require about three to five minutes. Next, turn the black side down and immediately take your transfer paper or celluloid and slide it into the tray underneath your carbon tissue, having both under the water, and then carefully and steadily draw the carbon onto the support. *Be sure that both are under the water* when this is done, otherwise the surface of the print, which is very sensitive, will be marred.

156. As soon as the carbon tissue is properly located on the celluloid, lift both together from the tray, by holding at one end with the first finger and thumb of each hand, and place the print, celluloid side down, upon your glass squeegee plate. Cover the print over with the rubber cloth; then with the flat squeegee thoroughly expel all water or air-bells that may be between the celluloid and the carbon, thus bringing the carbon and support into *perfect contact*. Sometimes a roller squeegee will help you to expel these air-bells better and give you better contact, but it is well first to mop off the surplus water with a flat squeegee, then roll over gently with the roller squeegee. *All air-bells must be eliminated*, so the squeegeeing must be very thorough. After squeegeeing, place the print between dry blotters on a table or some level surface, then weight it down with a sheet of heavy plate-glass or ordinary glass with some light weight upon it. Allow the prints to remain under weight for at least fifteen minutes.

157. **Beginning of Development.**—After fifteen minutes have elapsed, the print on the transfer paper is placed in the developing tray, or in other words, the hot water bath of 80° Fahr. The print should not be bent or twisted

during this process, or the tissue may be separated from the transfer paper around its edges. That is a difficulty to be avoided as much as possible. The water in the dish should be comfortably warm, about 80° Fahr. It is advisable to have a suitable thermometer in order to correctly gauge the temperature. After some experience with the printing and developing of carbon paper, it will not be necessary for you to use any other guide than your fingers. If you cannot bear your hands in the water, it is too hot, while if it does not feel decidedly warm, it is too cold. It is also very important, when changing the temperature to a higher one, to make the change gradual, rather than subject the print to sudden changes of temperature.

158. Into the first water, the temperature of which is approximately 80 degrees, slide the print, with the celluloid side down. If it tends to float to the top, push it gently down with the fingers. If air-bells appear on the surface remove them with the camel's-hair brush. After a lapse of half a minute or so in the warm water the black coating will begin to dissolve and will ooze out at the edges of the print. *This stage should on no account be hurried.* No harm will result if the print is left untouched from two to five minutes after the pigment is seen to be coming out of the edges, and, indeed, anyone not familiar with the process will find less likelihood of failure if the tissue is allowed to remain for five to eight minutes in the warm water before commencing to strip. If the black pigment does not ooze out of the sides in a few minutes, catch the edge of the print between the thumb and first finger and gently shake it in the water. This will start the black pigment dissolving.

159. **Stripping Off the Backing Paper.**—The next operation is to remove the paper which forms the back of the carbon tissue, leaving the picture in an undeveloped condition on the transfer paper or celluloid. To do this, when you are sure the time is right as described in the foregoing paragraph, gently raise one corner of the paper with the point of a pin, or use the finger nails, and then

catch hold of it with the fingers, keeping the print under water; then bend it right back and with a smooth, even motion, peel it off. If the corner will not pick up freely from the start, this will indicate that the film is not sufficiently softened; again immerse it in the hot water for another minute or so and try it once more. Do not fear damaging the tissue, even should you fail the first time, as it is by experience that you learn.

160. This operation may seem rather a rough sort of treatment, and one that you would think would injure the delicate surface of the print underneath it, but such is not the case. Moreover, this manipulation should not be carried out in a nervous or hesitating manner. We do not advise being rough about it, of course, but always strip it quickly and straight. The paper as it comes off may bear signs of the picture or it may not. It may also show what seems to be bubbles and blemishes, from which you may be led to suppose your print was a failure, but it by no means follows that this is the case, and you may throw away the tissue paper backing, discarding it entirely. Concentrate your attention to the transfer paper or celluloid, which now lies in the warm water with a mass of slimy looking pigment upon it. *This mass contains the picture and the surface is very delicate.* From now on to the finish no solid matter must come in contact, however gentle, with the face of the image.

161. **Caution.**—It is extremely important, when removing the backing from the transfer paper, not to hesitate, but draw the tissue evenly with one continuous draw, for should you hesitate and pull in jerks, wherever you stop there will be a line across the face of the print, which will be somewhat difficult to remove when developing.

162. **Finishing the Development.**—The water in the tray will by this time have cooled somewhat and should be discarded. Having previously provided a fresh supply of water in an ordinary tea-kettle, at about the original temperature, hold the print over the tray and from the tea-kettle pour the water in a gentle stream over the face of the print.

It is quite possible that the picture will almost immediately begin to make its appearance, as the excess of the pigment gradually washes away where it is not required to form the image. In other words, the insoluble portions of the pigment remain in contact with the transfer paper, while the soluble particles are dissolved and washed away. Continue to pour the fresh warm water gently over the print; or you may turn the print face over and allow it to flow face downward on the warm water, and in this way it will develop itself. Should the development proceed too slowly, then gradually increase the temperature of the water or transfer the print to your second tray containing water heated to 100° or even 110° Fahr., and, with the hand, spray the water upon the print. At this stage hold the print out of the water. The spraying of the water on the carbon will gradually eat away the black pigment until the entire image is developed, which will require from five to fifteen minutes. Do not make any attempt to stop development when the print seems to be about the right depth, as greasy looking spots will be the result, indicating that development has not been finished. On the contrary, go on developing as long as the warm water seems to be dissolving anything from the print. This is the only way you will be able to judge whether or not the exposure has been correct.

163. When the development is finished, rinse the print in cold water and with the finger gently rub the white edge or margin of the celluloid or paper support, cleaning it thoroughly before fixing.

164. **Note.**—Should there be any portions of the print which you desire to have dissolved away more than others, you may dip up some of the warmer water in a small cup, and gently pour it on those portions which you desire to have dissolved away.

165. **Hardening Bath.**—The hardening bath should have been prepared previously to starting to develop the print. This bath is composed of 1 ounce of potash alum to 30 ounces of water. Nothing but plain potash alum should be used for this purpose. Allow the print to remain in

this bath for five minutes in order to thoroughly harden the pigment image. When this is accomplished, remove the print from the bath and rinse off in clear water for five or ten minutes; then, with photo clips, hang up to dry. Should the whites appear slightly yellow or muddy, add one grain of sulphite of soda to the alum bath; the sulphite will purify the whites.

166. What the First Print Teaches.—As soon as the print is placed in the alum bath it may be regarded as finished, and upon its appearance you will be able to judge whether or not the exposure has been correct. Assuming that the negative was a good one—a vigorous negative is essential for carbon work—if the print has a pale, washed-out look, printing was not carried far enough; if it is dark and heavy, printing has been carried too far. By looking at it and noting the appearance of the guide print made on the printing-out paper, you will be able to decide how deep to carry printing the next time. The second attempt should result in giving a print which will please in every respect; if you have made a careful study of your first experiment. The first guide print may be kept handy, in the dark, and compared from time to time with the second guide print.

167. A Possible Source of Trouble.—There are a few sources of trouble, which, although possible, are not probable, yet we desire to point them out in order that you may avoid them. Always procure pure potassium bichromate, for if the impure chemical is used, or if the tissue is dried in air contaminated badly with fumes from burning gas, the coating may become insoluble without any exposure to light at all. This generally manifests itself by the tissue refusing to adhere to the transfer paper. To make sure that the tissue is in perfect condition before printing, you may cut a narrow strip off one of the pieces and put it in cold water for a minute or two until quite limp. If you then place it in warm water and the coating dissolves entirely, it is in good condition. If it does not dissolve, the tissue is useless. It is not at all likely that this will occur, but we mention it here in case a beginner should be so unfortunate

as to find that his first attempts are failures from such a cause. If you have tried the tissue in this way and find it to be in good condition, and still your print will not adhere to the transfer paper, either it is very much overprinted, or, what is more likely, you have left it soaking too long in water before squeegeeing it to the transfer paper.

168. Should you be troubled with blisters, you will find that they are caused from one of two things—either too hot water or too strong an alum bath. Be sure that the water is not too hot, and if the alum bath is too strong reduce it by the addition of a little more water.

169. **The Completion of the Print.**—There will be a slight yellowness about the whites of the print when development is finished, but the alum bath will remove this and will at the same time harden the film forming the picture. Fifteen minutes is long enough for the print to be left in the alum, and as previously stated, it may then be washed in a few changes of water and pinned up to dry. The print can then be trimmed and mounted in any way that seems desirable. It will be perfect in tone; *i. e.*, it will be the same color in every part. There can be no toning troubles in carbon work.

170. A carbon print is absolutely permanent—the picture will last as long as the transfer paper itself. It will be found to differ in one way from other prints, namely, it will be reversed right for left. In some cases this is important, and for these some device has to be adopted to prevent the reversal, but instruction for securing proper results along these lines will be dealt with in the chapters following. The instruction in this chapter is intended to cover simply the first attempts and give an elementary idea of the fundamental principles employed, and to show how very simple are the operations which carbon prints require, and how very few are the requirements in the way of apparatus. The material which we have named is that with which we should recommend any beginner to start, as it is easier to use than some of the warmer colors of tissue and rougher surfaces of transfer paper.

CHAPTER VI.

Carbon Process.

Part III.

Practice Work.

171. For your first practice work with carbon printing, all the material required, besides your paraphernalia for manipulating the process, is a couple of dozen sheets of carbon tissue the size of the negative you wish to print from. We advise purchasing carbon-black for your first work. Besides the tissue procure half a dozen sheets of celluloid. Of course paper supports can be employed, but when using the paper supports for the carbon, should you meet with failures the supports will be ruined and cannot be used over again. With the celluloid, all that is required is to wash off the surface and use the same celluloid for the second attempt. For this reason, we recommend the use of the celluloid for first work at least.

172. Besides the celluloid, you will want some bichromate of potassium. A few ounces will be sufficient. The celluloid sheets should be white matt, and a trifle larger than the prints you want to make. For a 4 x 6 print made on a 5 x 7 negative, you should use 5 x 8 celluloid. This gives a larger safe edge and there is less danger of marring the print. You can get along with one hot water tray. In fact, any flat vessel in the shape of a tray in which you can heat water, is suitable for the developing tray. If but one tray is used, you must have some hot water in another vessel heated ready for use. A tea-kettle is a splendid thing to keep hot water in ready for use.

173. It is advisable to sensitize a few sheets of the tissue the day before you expect to use it. It is also advisable to make an actinometer according to the previous in-

structions given, as this instrument is easily made and can be used for all future work. For preparing your actinometer, place your negative that you expect to use for making your carbon prints in one printing-frame, with a sheet of printing-out paper on it—Solio or any printing-out paper will do. At the same time place a piece of paper on your actinometer and place that in a printing-frame also. Place both in the light to print at the same time. When the paper is pretty well tinted on the negative, which will require from three to five minutes, depending entirely upon the the quality of negative employed, withdraw both frames and examine the print and if the highest lights are not yet tinted, again place out to print. Occasionally examine the print, and just as soon as the highest lights show a slight tinting and the image is fairly clear (*like a good printed proof*), then take both the frames in from the light. Examine your print on the actinometer. Note the highest number which shows a slight tinting of the paper. This number is your key and your future guide.

174. Place the carbon tissue on the negative in the printing-frame, at the same time place a new slip of proof-paper on your actinometer. Place both frames out to print. The carbon tissue, of course, do not disturb, as there is no visible image on it. That is why the actinometer is required, for when the print on the actinometer registers to the number of the required tint, then the carbon print is completely printed. To make this more clear, we will suppose that when testing the strength of your negative the actinometer registered a faint tint on No. 7 layer. Number 7 is then your key. Print the carbon until the new slip of paper placed upon the actinometer registers to No. 7—both the actinometer and carbon having been placed in the light to print at the same time. When the tinting has reached this number the carbon is completely printed.

175. You may then proceed to develop the tissue. It is better, however, to make two prints before developing. This will give you a better opportunity for experi-



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menting. When ready to develop, place your celluloid supports in a tray of cold water to soak for a few minutes. In another tray of cold water place the carbon tissue. The tissue will curl slightly. It will also become covered with air-bells (bubbles). These must be removed with a soft camel's-hair brush. Dip the brush in the water first—never touch a print with a dry brush. When the tissue becomes flat, which will only require a few minutes soaking in the water with the face side (black side) down, slip one of your celluloid sheets under the tissue and gradually draw the carbon on to the celluloid, with the black side next to the celluloid. This must be done under the water. The combined tissue and celluloid are then withdrawn from the water and laid on the squeegee plate and squeegeed in contact, after which they are weighted down and allowed to remain for fifteen minutes.

176. The print is now ready to strip. Place it first in a hot water bath about 80° Fahr., and when the print shows signs of considerable oozing out at the edges, this will indicate that the thin layer of gelatin over the pigment is sufficiently softened and the back can then be pulled off from the pigment with one straight pull, thus leaving the image transferred to the celluloid. You then develop the print until the image appears clear and clean.

177. If the first bath of hot water at 80° is not sufficiently hot to develop the print, make a new bath 100° to 110° Fahr. and complete the developing in this bath. It is really better to increase the hot water gradually, as to jump from 80° to 100° is liable to produce blisters. Therefore, we advise that the fresh hot water bath be first made 80°. After the print has been in the tray for a few minutes, gradually increase the temperature, thus avoiding failures.

178. When the print is entirely developed it is then passed through the alum bath, after which it is rinsed in plain water and is ready to hang up to dry. Your first two or three experiments will prove a splendid guide for your future work, even should they be partial failures.

179. By consulting the *Difficulty Department*, you will

readily find the cause, prevention and remedy for any failures met with. Always save first prints, and having observed the appearance of the prints during each operation, note on the back of the test prints all data pertaining to their production, and file them in the proof-file for future reference. Practice work for the following lessons on carbon printing should be carried out in the same manner, always saving first efforts, noting all data regarding manipulation on the backs of the prints, also filing them in the proof-file for future reference.

CHAPTER VII.

Carbon Process.

Part IV.

Care of Material and Detailed Instruction for Sensitizing the Tissue.

180. In the preceding chapter the process was covered in a general way. We did not explain the whys and wherefores of any particular part of the process, believing that the worker, after having had some experience with the various manipulations, will more quickly comprehend the terms which we will use in explanation of the different phases of the work.

181. In future instruction each department will be taken up separately, and instruction given on how to produce equally good results by different methods. We will supply different formulæ, so that should you experience difficulty with any one method the other can be tried.

182. In this instruction we will treat on the sensitizing of the tissue. We wish to dwell principally upon cleanliness and the care of the materials with which you are working. This being the foundation of all successful operations, we consider it advisable to guard you against expensive failures by cautioning you at this point.

183. It is very important that all chemicals and materials used in the carbon process should be kept in a cool, perfectly dry place. A stuffy room will not do. A room with good air, perfectly dry and free from gases or odors of any kind, is preferable.

184. All chemicals should be properly labeled. Your paper should be placed in boxes, and held flat by the weight of a piece of glass, or anything flat. Carbon tissue is apt to curl with age, thereby making it quite difficult to sensitize, and in trying to straighten it out you are apt to crack the

film. To avoid this, keep the paper in its original wrapper. The best method of keeping carbon tissue in a pliable condition and ready for use is to store it in a tin receptacle which can be kept well closed.

185. **The Work-Room.**—The real causes of many failures in carbon printing are found to come from poor work-rooms—rooms containing foul air, dampness, mustiness, odors from gas pipes, oil stoves, or the like. Such rooms are not fit for sensitizing the carbon. Steam heat is the best. Gas or coal stoves can be used, but see that no gas escapes, and allow no odor in the room from these gases. Never use kerosene. Few workers seem to understand the importance of a good, clean work-room. A properly arranged room, with the necessary apparatus, should be the first consideration. You require no elaborate, expensive apparatus. All that is necessary is cleanliness and plenty of fresh air, and a careful worker should have everything in its place. With every article in its place, properly labeled, the worker cannot help being successful.

186. The proper light for a work-room is similar to that of the ordinary toning-room. The only important difference is, that the light has no particularly bad effect on the unsensitized tissue, yet it is best to keep it in subdued light. The tissue in its wet state can be handled in good light, yet a subdued light is better. The paper grows sensitive only as it dries. When dry, it is two to three times as sensitive as printing-out paper; therefore, the drying-room must be absolutely light-tight.

187. The room used for sensitizing the tissue should not be used for the drying-room, as you are apt to spill some of the solution and cause dampness in the room, which will delay the drying of the carbon tissue. Moisture in the room is apt to cause mustiness and mold in the tissue, and long, slow drying will cause tear drops and streaks; so do not attempt to dry your paper in your sensitizing room.

188. The sensitizing bath given in Paragraph 130 will generally work under all conditions of weather. The

bichromate salt is the actual sensitizing agent, but various other chemicals are frequently added to offset certain conditions of weather, or to improve the quality of the tissue. In cold weather the strength of the sensitizing bath must be increased, as the action of the cold decreases the sensitiveness of the tissue. Very frequently bichromate of ammonia is used in place of the potash, as the ammonia salt has greater sensitizing power for thin or weak negatives, so when troubled with weak prints we advise the use of the ammonia salt.

189. In damp weather, or in climates where there is considerable moisture, the following formula will work well:

190. **Formula No. 3.—**

Water	98 ozs.
Salicylic Acid	100 grs.
Bichromate of Potassium	2 ozs.
Plain Glycerin	1 oz.

Dissolve the acid in a little of the water and the potassium in the rest of the 98 ounces. Then add the glycerin, which acts as a restrainer, and filter through absorbent cotton.

191. With very strong negatives the bath should be increased to 5% strength of bichromate. On the other hand, if the negatives are weak and thin, the strength of the bath should be reduced to as low as 1%, if necessary. In this way considerable control is had over results from negatives of different densities.

192. In hot weather the tissue is liable to become insoluble before it is dry if a strong bath is used; therefore, a weak bath should be employed, averaging about 2% in strength.

193. A very good summer bath, one which has proven very satisfactory in the hands of competent workers, is as follows:

194. **Formula No. 4.—**

Bichromate of Potassium	2 ozs.
Carbonate of Ammonium	1 dr.
Pure Alcohol	2 ozs.
Water	100 ozs.

195. If the negatives are thin and flat, add 1 ounce of glycerin. For *winter* use this same bath can be increased to 3 ounces of bichromate. In *summer* the sensitizing bath should have a temperature of 50° Fahr., and certainly not over 60°.

196. Carbon tissue is much more soluble in a bichromate solution than in water, at the same temperature. If the sensitizing room is warm, the sensitizing bath should be set in a water bath, to which ice has been added. In winter the bath may register from 60° to 70° Fahr.

197. Use hot water for dissolving the bichromate salts, as they do not dissolve readily in cold. It is well to make up the different baths and label each bottle or jar with the formula printed thereon. The sensitizing baths will keep well if placed in dark colored bottles and protected from the light.

198. **Sensitizing the Paper.**—When ready for sensitizing, decant or filter sufficient of the solution into the tray for sensitizing the tissue that you expect to use within a few days. If only a few prints are sensitized this bath may be poured back into a bottle and used again. If many sheets have been prepared, then we advise that you throw away this bath each time after using, as the material is not expensive and better results are obtained from fresh baths. A bichromate bath containing glycerin, carbonate of ammonia, or other organic substances, will be reduced by the action of the light, therefore should not be used too often, as it is more economical to make up the bath frequently.

199. There are a few points that must be remembered when sensitizing tissue. Weak prints are generally caused from weak sensitizing baths, providing the negative is of the proper strength. Therefore, sort your negatives, using a strong bichromate bath for those that are somewhat hard and contrasty. Where you ordinarily would use two ounces of bichromate increase this quantity to four. For average negatives three ounces of the bichromate is generally sufficient. Again, the weaker the negative to be

printed from, the weaker should be the sensitizing bath. The action of light will be much slower, resulting in more vigorous prints.

200. It is essential, when sensitizing the tissue, that no air-bells exist upon the paper. The tissue, or paper, is immersed under the solution, face side down, and with a camel's-hair brush air-bells are removed from the back. After the print is immersed for one minute face side down, turn it over with film side up, again expelling any air-bells that may appear. The print must at all times be kept under the solution.

201. When the tissue shows signs of curling backward, you are sure of its being sufficiently sensitized. There are times, however, when the tissue will lay flat and will not curl at all. Therefore, do not wait for this to take place, as the time for sensitizing should not exceed three minutes. Anywhere from two to three minutes is generally sufficient.

202. **Mopping and Drying the Tissue.**—Great care must be exercised in drying the tissue. Lifting it from the bath and placing face downward upon the squeegee plate, cover with a rubber cloth, and with the squeegee swab the surface lightly at first, and then more vigorously, to remove all the superfluous solution as thoroughly as possible from the face and back of the tissue. Remove the rubber cloth and with a clean blotter mop up the remaining solution. Then, catching the print by the corner lift it from the plate.

203. While ordinarily a photo clip attached to one corner of the tissue will hold the film flat, yet, there are times when the paper will curl considerably, and to avoid this curling we advocate using small strips of wood. Lay the strips across the upper edge, the tissue between the two strips, and clamp them together in the center with one photo clip. Arrange the bottom in a like manner. These strips will hold the tissue perfectly flat, and it will dry nicely in this way.

204. If you have but a few sheets to sensitize, you

may allow the tissue to remain squeegeed flat upon the squeegee plate and place in the drying-room to dry. This method protects the film from dust, injurious gases and vapors that might be present in the room, and when it leaves the plate its surface is as smooth as glass, usually resulting in a better and more perfect contact with the negative.

205. **Drying-Room.**—The drying of the sensitive carbon is one of the most important parts of the process. The room used for this purpose must be clean and dry. Have plenty of fresh air, if possible. Any foul gases, vapors, or stench of any kind is ruinous to the sensitized tissue.

206. The room must be perfectly dark. A ruby light, or the light of a candle, is all that should be used in this room. Do not use kerosene lamps, as the odor from the oil will have a bad effect upon the tissue. The proper drying of the tissue determines, to a certain extent, the sensitiveness and solubility of the tissue and brilliancy of the picture for which it is employed. Therefore, strict attention must be paid to this part of the process.

207. For the temperature of the drying-room, from 50° to 60° Fahr is about right. In the winter months it can be increased to 70°. Paper sensitized in a strong bath should be dried quicker than that sensitized in a weaker solution. The weaker the solution the slower the paper should dry. Ordinarily the proper length of time occupied in drying is from five to eight hours—it should never be less than five, or more than eight. Tissue that has been dried rapidly adheres readily to any support, and will develop more readily in water of a low temperature. Such a tissue, however, if printed from immediately when dry will lack in gradation and half-tone.

208. In case you have such paper already prepared and must use it, you can improve upon the general results by exposing the film side of the tissue to the light for a few moments, thus tinting it a trifle. Do this before placing upon the negative. In this way you can produce good half-tones, which otherwise would be lost. Better results

can be produced from such paper when it is three or four days old.

209. The most sensitive carbon tissue is that which is dried quite slowly—say six to seven hours—and the prints are much softer providing you use good, snappy, contrasty negatives; otherwise the results will be mushy and sunken appearing, and the development will be slow and difficult. Too long drying causes the film to become insoluble, to lose its adhesive properties, sometimes to blister in the developing, and often becomes entirely worthless.

210. On the other hand, if the tissue is allowed to dry too quickly it becomes brittle and is liable to crack, and at the same time its sensitive properties will be greatly impaired. Should the paper become brittle by rapid drying, this can be alleviated by subjecting the tissue to the action of moist atmosphere. Scattering the tissue out on a table in a damp room for a few minutes will make it pliable and suitable for working satisfactorily.

211. Sensitized tissue that is not to be used at once should be stored flat in a plate-box, and held down by a heavy sheet of glass. Better still, a tin box can be arranged with a double perforated bottom, in which is stored some asbestos fibre soaked in calcium chloride. This prevents the tissue from becoming too dry. Or, the sheets can be rolled up and placed in a tin platinum tube, in which the soft lumps of preservative have been left.

212. Another method is to lay a sheet of glass in a printing-frame; over the glass lay a piece of opaque paper, and on this, face down, lay the sheets of sensitized tissue. The back is then clamped on, and the tissue will be kept flat and in good condition for several days.

213. A few points would be well to remember at this time: The stronger the bichromate bath the more rapidly can the tissue be dried; the weaker the bath the slower it should be dried.

214. A most convenient way to work is to sensitize the tissue in a normal bath the evening before you ex-

pect to use it. Have the room at a temperature of not more than 60° Fahr., when the paper should dry in from seven to eight hours. In doing this the paper should be gathered up the first thing in the morning and placed in a light-tight box, weighted down with a glass weight.

215. **Colors of Tissue to Use.**—Standard brown, warm black and sepia are generally considered the best colors to use for portraits. For landscapes and seascapes, sea-green, marine-blue, and sometimes red chalk will give you a very pretty effect. It is essential that you select the proper color of tissue to suit the negative or view from which you expect to print. As each color has some little peculiarities of its own, we consider it advisable that you try to perfect yourself on as few standard colors as possible, and only use the odd colors for experimental purposes.

216. When employing red chalk, sepia, or any warm-colored tissue, as these colors are generally used for sketchy effects, they require a strong bichromate bath, for the reason that they are not printed so deep, and unless the bath is quite strong they will bleach out in the developing. For this reason use a stronger bath, doubling the amount of potash given for the normal bath.

CHAPTER VIII.

Carbon Process.

Part V.

Detailed Instruction for Printing Carbon Tissue.

217. The first consideration, before placing the tissue on the negative to print, is to sort the negatives. In the previous chapter you were instructed to use a weak bichromate bath for sensitizing tissue to be used on weak negatives, a strong bath for hard negatives, and a medium-strength bath for medium strength negatives. Therefore, it is advisable to sort the negatives before printing from them. Your weak, soft and flat negatives place by themselves, and use tissues sensitized in a weak bath for printing from them.

218. Negatives of medium strength, or negatives with a good, strong body, will make good prints on tissue sensitized with almost any strength bath. Extremely hard negatives should be printed on tissue sensitized in a very strong bath. To avoid different strength baths in sensitizing the tissue, you may reduce very hard negatives before printing from them, and in case of weak negatives intensify them. This will make your negatives more uniform—in fact, you should strive to make all your negatives of a uniform strength—and a uniform sensitizing bath can then be used for all.

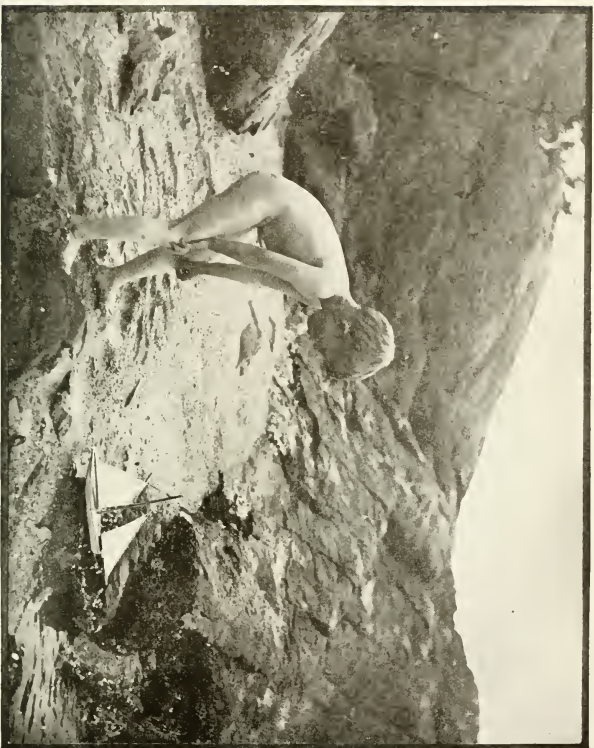
219. Before placing the negative in the printing-frame, it is necessary to prepare the safe edge. If this be neglected it will often happen that, on developing, the prints will not adhere to the transfer or support. Insoluble gelatin will not adhere well to the temporary support or single transfer support, therefore, if the edges are masked so that they will not be exposed to the light, they will adhere more readily to the support than the exposed parts. You are, therefore, sure to have an even transfer all around

the edge, and this edge will hold the balance of the tissue in place.

220. This mask should be placed on the film side. While it can be placed on the glass side, and will give more softness and a slight blending of the outline in the printing, yet when mounting on celluloid or porcelain, or even etching paper, it is best to put the mask on this side. When using heavy, coarse paper for support, then it is alright to place the mask on the glass side.

221. **Printing the Tissue.**—Care must be taken that the tissue used is large enough to more than cover the opening in the mask. The paper is placed in the printing-frame in the usual manner. You must select such frames, however, as have good, strong springs. First dusting the negatives and then the tissue with a fine camel's-hair brush, place the tissue, face down, on the negative, and cover it with several thicknesses of good, dry blotting paper. Replace the back of frame and fasten the spring. This blotting-paper is to secure perfect contact between the tissue and the negative. The tissue is heavy, and when drying after sensitizing is liable to buckle in places. There will be a blur in the image wherever perfect contact is not secured.

222. Having judged your negatives according to the number on the actinometer, and having recorded this number upon the negative, as described in Paragraphs 145-153, you can now place this frame in the light to print, at the same time placing the actinometer in the same light. By recording the actinometer number on the plate you will know exactly what depth to print to each time you print from this negative. By also placing the actinometer number on a white sticker and pasting the sticker on the face of the printing-frame, you can print from several negatives at one time, using but one actinometer; withdrawing all frames of the same number at one time and continuing others of a higher number until the actinometer registers that number, being guided entirely by the actionmeter number on the printing-frame.



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THE LITTLE AEOLUS

CORA STANWOOD COBB

223. There are many ways of favoring imperfect negatives in the printing. For instance, by putting the printing-frames containing thin negatives in a more subdued light you will secure more crisp prints, and placing the intense negatives in a stronger light they will not only print faster, but give you better results. Never print carbons, however, in bright sunlight; a diffused light is preferable.

224. No matter how excellent or perfect a negative may seem to be, it will always admit of some improvement being made on some part or other by suitable methods. A great many failures to obtain satisfactory results from apparently good negatives can be charged to carelessness and oversight on the part of the printer in the "make ready," or the preliminary preparations made upon the negative previous to exposing the tissue to light. It is well to take plenty of time preparing the negative before printing from it. You will be amply rewarded for the time spent by softness and harmonious effects.

225. In portraits the face and draperies, even the background, can be wonderfully improved by careful treatment. Landscape negatives can generally be improved in the "make ready."

226. **Dodging in the Printing.**—For a portrait negative where the entire image is flat, we advise covering the glass side with Prussian-blue water-color. This can be procured from any art store. If any portions of the negative are sufficiently dense and do not need intensifying, with the finger rub off the color from these portions. If you wish to strengthen any particular high-lights in portraits or landscapes after applying the blue, coat these portions with a little yellow gamboge. This latter is a sort of paste and is applied like the former (Prussian-blue water-color), by placing a drop of the paste on the parts to be covered, and with the end of the finger tapping the paste gently it will spread uniformly and will not leave any streaks. Understand, do not rub this paste, but simply tap it with the edge of the finger, as you would tap with a

hammer. The grain of the flesh in the finger will produce a soft, stipple effect upon the plate. Any portions you would like to print stronger than others must be softened less.

227. Another way of holding back weak shadows is to cover the entire frame with tissue-paper, and before placing the tissue to be printed on the negative, hold it up to the light, look through the negative and note the portions you wish to strengthen or hold back. Dip the finger into some dry yellow ochre and rub over the tissue-paper on the parts you wish strengthened. This will give you very soft effects, equal to former methods, and is much more simple and less expensive. Any of these methods can be employed. The yellow being more opaque than the blue, care must be exercised that you do not apply it too heavy. Should you desire any odd figures or designs introduced into the background, by the application of the gamboge you can cover the portions where you expect to design your figure, and then with the etching knife or with the blade of any ordinary penknife, you can scrape away the surplus paste applied. Some very catchy designs can be worked in the negatives in this way.

228. As previously stated, after a little experience several negatives can be printed from at the same time, using one actinometer, carefully noting the exact number to which each must be printed; but all frames must be placed in the light at the same time, or as nearly so as possible; otherwise uneven prints will be the result. With a little practice the use of the actinometer becomes much easier, and several negatives can be printed from simultaneously as easily as one can be handled. You can always rely upon your actinometer as being exact, except during dull, damp weather. Then the carbon tissue is a trifle less sensitive, which must be allowed for accordingly in the printing. In extremely bright weather the reverse is the case; therefore, use diffused light in bright weather and you will produce uniform results. In winter the tissue is less sensitive than in summer, in proportion to the sensitive-

ness of the printing-out paper in the actinometer; therefore, in winter a tint one or two numbers higher should be taken for the guide.

229. **Continued Action of Light.**—While it seems very singular, yet it is true, that carbon paper continues printing even after the action of light has ceased. This printing is not always noticeable, yet the printing continues mildly after the prints are withdrawn from the light. As this action ceases as soon as the prints are wet, it is advisable to develop the prints almost as fast as they are printed. This peculiar action of carbon tissue is sometimes taken advantage of by expert workers, when the light is dull and a great many prints have to be made. The prints are removed before they are exposed for the full length of time, and are left in a drawer for several hours, when the continued action will make a full exposure. This, however, requires considerable experience to avoid over-exposure.

230. As the surface of carbon tissue is more sensitive than ordinary printing papers, you must avoid touching any portions of the print before it reaches the water. Even should the hands be perfectly dry, the marks from the fingers will show wherever they have come in contact with the print. After printing, place all prints, before developing them, in a light-tight box, face down, weighted with a piece of glass.

231. **Judging the Exposed from the Unexposed Tissue.**—There being no visible imprint by which to distinguish the difference between a tissue that is exposed and one that is not exposed, it might happen that the tissue which has been exposed will get mixed up with the unexposed. To avoid this trouble, mark the corner of the back of the sheets exposed "ex." Where several frames are being printed from it is well to mark the frames in a like manner. Should you neglect to place the exposed tissue in the proper box and accidentally mix it with the unexposed, by breathing on the film of the tissue you can judge whether it has been exposed or not. If it has been exposed the image will appear faintly, but will immediately disappear.

CHAPTER IX.

Carbon Process.

Part VI.

Detailed Instruction for Developing the Image for Single Transfer.

232. The picture printed from glass negatives is reversed on account of the tissue being transferred and developed upon another support.

This transfer is absolutely necessary on account of the image being formed under the surface of the tissue, which is insoluble. Therefore, in order to develop the concealed image it is necessary to transfer the carbon tissue to another support and develop from the back of the tissue, where the light has not penetrated, and the gelatin, in consequence, is unaltered.

233. Carbon pictures are developed with plain hot water, which softens the paper or original support and makes soluble the unaffected parts of the gelatin, which then allows the paper to be removed. The image is thus exposed to the action of the hot water, which dissolves and washes away all the soluble parts, and with it the pigment or coloring matter it contained, thereby clearing the image and effecting the development.

234. **The Single Transfer.**—If a carbon tissue which has been regularly exposed (printed) under a negative is placed in a tray of cold water, and allowed to absorb the water until the tissue begins to flatten out, and is then brought into intimate contact with a specially prepared paper or any smooth material impervious to water, such as transfer paper, celluloid, porcelain, etc., the pigment paper will firmly adhere to these during the process of development, providing all the conditions pertaining to the sensitizing and drying of the tissue have been strictly adhered

to, and will dry down with a smooth surface, where it will remain permanently and will not leave the support.

235. This is called the single transfer process, on account of the one transfer and because the image is developed upon the final support. This process is used almost exclusively by the majority of the carbon printers, and the resulting pictures are as good as the more difficult double transfer process, the only difference being that the pictures printed from the ordinary negative are reversed.

236. Where negatives are made specially for carbon printing, this obstacle may be overcome by reversing the plate in the holder, glass side to the lens, and when making the exposure you do so through the glass onto the film. You should invert the ground-glass in the camera with the ground surface on the outside to assure a sharp focus. Usually, a reversal of the image is not objectionable, especially in portraiture; therefore, we advise making the negatives in the regular way and using single transfer process. No one will know the image is reversed except the printer. If the print is being made from a film, it is, of course, only necessary to print through the back of the film to obtain a correct image; the slight thickness of the film will not mar the sharpness of the print to any material extent.

237. **Carbon Supports.**—The final support for single transfer can be procured already prepared, in all grades and kinds. The paper supports are supplied by dealers, in cut sizes, large sheets, or rolls. There are different grades—smooth, medium, rough, etc. One side of this paper is especially prepared for receiving pigmented paper. The coating is such that water will not penetrate through it, thus supplying a solid, impervious support. The paper is coated with a substratum of insoluble gelatin, which may be distinguished from the uncoated side, when dry, by its lustre. The gloss is not noticeable when wet; therefore, as a precaution, mark the back of each piece of paper before immersion.

238. Any kind of paper already prepared may be used as a final support. For very artistic effects heavy,

coarse drawing paper prepared with the same substratum will supply a good support.

239. To prepare paper specially for support, coat with the following solution:

Gelatin	2 drs.
Cold Water	14 ozs.
White Sugar	40 grs.
Chrome Alum	80 grs.

240. Soak the gelatin in the water for about one hour; add the sugar, and then melt the gelatin by placing the vessel containing it into hot water. Procure a kettle larger than the vessel containing the gelatin, and pour one quart of water into it and place it on a stove to boil. Into this kettle of boiling water place the vessel containing the gelatin, and allow the water around it to boil. When the gelatin is thoroughly melted, dissolve the chrome alum (80 grains) in two ounces of water, and add this chrome alum solution, a few drops at a time, to the gelatin, and stir vigorously while the water is boiling around the inner vessel. If the mixture should thicken up, add one-half a dram of glacial acetic acid. Stir well until the mixture is quite limpid. Filter this mixture while still hot into a tray which should be a little larger than the sheet of paper which is to be coated. With wood clips, attach a thin strip of wood on the back of the sheet to both the top and bottom, and float the paper on the bath. Hold the paper over the bath with both hands and carefully lower the end in the right hand first; then gradually raise the right hand, at the same time lowering the left. Repeat this operation about four times.

241. Now lay the paper, face side up, on a clean blotter and examine the surface for bubbles. If any exist, dip a small camel's-hair brush into the gelatin mixture and cover these spots evenly. A much more convenient, and equally as good, way to coat the paper is to lay it on some smooth surface and with a three-inch camel's-hair brush apply the gelatin mixture evenly over the sheet. As soon as the mixture is set, the sheet may be suspended in your

drying-room, away from dust, to dry. Paper so prepared will keep for any length of time, providing it is stored in a perfectly dry place.

242. The substratum, or gelatin mixture, which is left after preparing what paper you need, should be returned to the vessel in which it was prepared and saved for future use.

243. **A Convenient and Systematic Arrangement of Trays for Development.**—Convenience and system are quite an advantage in the successful manipulation of carbon paper. The following is a very convenient arrangement for trays: First, provide yourself with quite a long table. On the end to your left, place a tray containing clean, cold water. Next to the tray place the mounting or squeegee plate; then comes the developing tray or hot water tank. This tank can be an ordinary zinc tray, 8 x 10 inches or larger. A more convenient tank would be one 25 inches long, 4 inches deep, with a partition through the center, thus making two tanks in one, each tank 15 x 12½ inches. In such a tank, carbon prints any size to 11 x 14 can be developed. This tank is arranged on stilts, about 10 inches above the table, or sufficient to allow a gas or oil stove being placed underneath.

244. Temporary stilts may be provided by using a couple of ordinary bricks under each end of the tank. The principal object of the double tank is to supply one tank of water heated to a higher degree of temperature than the other. The temperature of the one would be from 80° to 100° Fahr., and the other should be from 100° to 115° Fahr. By means of the heater and double tank, it will be very easy to increase the temperature of either or both baths instantly. If a single tray is used, heat the water in a similar way and have on hand a kettle of boiling water to be used to increase the temperature when desired.

245. To the right of the hot water tank, place another tray of cold water, in which to rinse the carbons before placing them into the alum bath, which latter is prepared in a zinc, or any other tray and placed next to the rinsing

tray. From the alum bath the prints are again transferred to a cold water bath, temperature about 60° Fahr. In this bath the prints are freed from the alum and the operations are completed.

246. Now, that the trays are arranged in convenient order, we are ready for developing. First of all, if your transfer paper is in sheet form, cut the required number to the correct size, always allowing a half inch larger than the tissue. If they are small pictures, several may be mounted on one piece of support and all developed at one time. (We advise beginners to buy the supports cut to the correct size, all ready prepared, as they cost no more than if you prepared them yourself.)

247. Remember, the transfer must be made in subdued light. After the tissue becomes well water soaked and the bichromate is well washed out, very little of the sensitiveness remains; therefore, the greatest precaution must be taken *during* the transferring of the support. The developing may be done in more open light. Place your supports, whether paper or celluloid, or whatever they may be, face up into the first tray on the left, containing cold water. Allow them to soak for say 20 minutes, or long enough to free the paper from all air-bells. If any appear on the surface after twenty minutes, expel them with a soft camel's-hair brush. The supports now being ready, take one of the tissues that has been printed and immerse it face down in the same tray with the supports. See that the dust is removed from both sides of the tissue before immersing. This you do with a soft (*dry*) camel's-hair brush.

248. Never allow the tissue to be raised out of the water. Always keep the tissue under water, and when air-bells arise on back or front, remove them with the wet camel's-hair brush. Allow the tissue to remain in the water until the gelatin is sufficiently swollen that the print lays almost flat. You will find as soon as the print touches water it will begin to turn inward. This is caused by the paper expanding more rapidly than the gelatin film.

As soon as the gelatin film has absorbed sufficient of the cold water, it will flatten out, and owing to the gelatin having a greater expansion than the paper, as soon as the print is flat it immediately begins to curl the other way; therefore, as soon as the print is flat, and before it curls in the opposite direction, bring it in contact with the support by gently sliding the support under the print, or bring the print up onto the support. Do this with both tissue and support under water, and when you have the tissue properly located and in contact with the support, then withdraw both from the water and lay them on the squeegee plate, cover with a rubber cloth and apply a flat or drag squeegee, rubbing them from center to edge, first gently, afterwards more vigorously, to bring the tissue and support into perfect contact.

249. Instead of a rubber cloth a sheet of clear celluloid can be used. This will not wrinkle up like the rubber cloth is liable to do, and at the same time, the presence of air-bells between the support and the tissue can be better detected. A squeegee roller can be applied at this stage to assure more perfect contact. After the squeegeeing, apply a dry blotter in order to remove all the surplus moisture surrounding the print.

250. Next place the print, now in contact with the support, between two dry blotters (one below and the other on top), stacking several prints one over the other. In this way allow them to remain for from ten to forty minutes, according to the age of the tissue and the kind of a support used. Paper supports need less time than celluloid. Fresh tissue requires less time than old paper.

251. If there are a large number of prints to develop, or if for any reason you cannot develop all the prints within a given time, remove the blotters from between the prints and stack them together, thus keeping them moist until you are ready to develop them. In hot weather or in hot climates, the coolest possible place should be selected for making the transfers. The warmer the weather the shorter the time the prints should rest under pressure, and

even then they should be kept in a cool place. The development, of course, can be carried on in any temperature, even a hot room. As the image is developed in hot water a sudden change to very cold water after development will affect the developed image.

252. **The Development.**—When the carbon tissue has been under pressure the required length of time, it can be removed and immersed in the first hot-water bath, which should not be over 80° Fahr. To immerse the print in a bath of higher temperature at the start would cause the tissue to be covered with air-bells. These bubbles or air-bells are caused from the air being suddenly expelled from the tissue and support by the hot water. If any of these air-bells should become imprisoned, the picture would be ruined. Therefore, it is advisable to first immerse the carbon and support in a lower temperature bath, and allow it to become well soaked. This will require only a few minutes. During this time be on the lookout for air-bells, and, as they appear, expel them at once with a camel's-hair brush or any soft material that will not require any heavy pressure, as that would spot the picture.

253. The carbon and support should remain in the first bath until the dark pigment begins to ooze out around the edge of the tissue, which is a sign that the gelatin has become sufficiently soluble to allow the paper to be removed from the back of the tissue. Sometimes this takes place in three minutes, at other times longer, much depending upon the condition of the carbon tissue. If fresh it should not require more than three, and at the most, five minutes. By this time, if the pigment does not ooze out freely all around the edge of the tissue, transfer the print to the higher temperature bath, which will bring about the desired results very quickly.

254. To make sure that the film is sufficiently soaked, squeeze the edge of the tissue gently with the thumb. If the pigment seems soft and oozes out more freely, then it is time to remove the paper or original support from the pigment film. You do this by taking hold of one corner

of the thin paper and pulling slowly backward, taking care to keep the transfer under water. The paper being of no further use can be thrown away. The film at this stage must remain carefully under water and not be allowed to come to the surface until the sensitive bichromate has been quite well washed out and the picture fairly well developed.

255. The pigment remaining in the transfer after the original paper support has been removed is quite clammy, and the image is not yet discernible, but on continuing the development with hot water it soon becomes clear and entirely developed. This stage is reached when, upon lifting the print out of the water to drain, no trace of coloring matter is seen on the edge of the support when the water runs off.

256. After the paper support has been removed from the tissue, it is well to carry on the development in the lower temperature bath, until it is quite evident from the action of the warm water whether the tissue was correctly exposed or not. If the image begins to clear up very rapidly, the tissue has been under-exposed and a still lower temperature bath should be used immediately. This may save the print. If the removal of the paper on the back of the tissue, even when placed in water of higher temperature, is accomplished with difficulty, it is an evidence of the tissue being rendered partly insoluble by over-exposure in the printing. When this is found to be the case, raise the temperature of the water gradually until the paper will strip freely, then lower it to about 90°. When hot water at 120° or 125° Fahr. fails to have the required effect, the only remedy left is to apply a little alkali, such as borax, carbonate of soda, or the like, borax being the best. A few drops of a saturated solution of borax added to a separate tray of hot water, and the print placed in this bath for a few minutes, should produce the required effect.

257. If the time of exposure has been exact and the negative is not too thin, the developed image should be very brilliant. If, however, the exposure has been too short

the shadows only will appear, the half-tones being washed away entirely by the warm water.

258. If the negative is too hard, the half-tones will disappear partially in the high-lights, but if the exposure has been too long, the image will not only separate from the transfer for the want of adherence, but the image will be quite pulpy. If a little boiling water is added to the warm water, making the bath 130° Fahr., the print, if left long enough, will generally become less dense. If only a portion of the image needs reducing, water heated to 130° in a kettle with a long spout, may be poured over the spot and the development concluded locally. After development the print is placed in a tray of clean, cool water for a few minutes, to stiffen the film before it is put into the alum bath.

259. **Alum Bath.**—Carbon pictures do not require fixing, but it is necessary to eliminate the bichromate, of which a certain quantity still remains in the tissue. In order to remove every trace of the bichromate of potassium, immerse the print in an alum bath, the bichromate being extremely soluble in a solution of alum. This bath has also the effect of hardening the film, thus rendering the gelatin entirely insoluble.

260. The print should be immersed in the following bath for at least ten minutes:

Water	60 ozs.
Potash Alum	2 ozs.

This bath must be filtered through cotton and can be used repeatedly, but must always be filtered before using, thus avoiding any specks on the film.

261. Where you experience difficulty in producing pure whites, a sulphite-alum bath should be employed, as follows: Dissolve 3 ounces of common potash alum and 1 ounce of sulphite of soda crystals in 100 ounces of soft water. Be sure and filter before using. If you use hard water, add 1 drop of tartaric acid to clear the solution before filtering.

262. Where it is desired to dry prints quickly by artificial heat or in the sun, the following hardening formula should be used:

Powdered Alum	3 ozs.
Sulphite of Soda Crystals	1½ ozs.
Glycerin	1½ oz.
Water (Soft)	32 ozs.

The bath must be filtered before use, and may be used repeatedly.

263. After this bath the prints are washed by handling in several changes of cold water for half an hour. After washing thoroughly the prints should be hung up to dry. If celluloid or any heavy support has been used for transfer, they may be placed in an ordinary negative rack and dried with a fan. They can be suspended in a room free from dust, with a current of air passing through. The prints should dry in a few hours when they will be ready for final mounting. Carbon prints on paper supports can be dried in a short time by first immersing in a weak solution of alcohol—½ ounce of alcohol to 8 ounces of water. Place the print in this solution for half a minute, then hang up to dry in the ordinary way. Never use heat for drying.

264. In order that you may become familiar with the rough-surface paper support, it is recommended that you apply this material to your next experiment. In using the rough paper, either prepare the paper yourself, or use the ready prepared stock. If you prepare the paper yourself, apply a heavier coating of the substratum than for smooth papers. Also greater care must be exercised in obtaining perfect contact and expelling all air-bells when squeegeeing the support to the printed tissue.

CHAPTER X.

Part VII.

A Condensed Table of Failures and Remedies for Carbon Printing.

265. **Failure.**—The pigmented gelatin shows signs of dissolving in the sensitizing bath, especially when touched with the fingers.

Cause.—Too warm a sensitizing bath.

Remedy.—The sensitizer should not be warmer than say 50° in summer, and not over 70° in winter. In summer the bottle containing the solution should be placed in cold running water, or the sensitizing bath should be placed in a large water bath, to which pieces of ice have been added.

266. **Failure.**—During drying the tissue shows signs of running.

Cause.—Too warm a drying-room.

Remedy.—A better ventilated room, or one fitted with fans. The addition of alcohol to the sensitizing solution is also recommended.

267. **Failure.**—The pigmented gelatin will not dissolve in the warm developing bath, even in those parts that have received no light.

Cause.—The drying took too long, owing to dampness of air; or, the tissue has been attacked by fumes from gas or oil; or an old sensitizing bath has been used.

Remedy.—The ventilation of the drying-room must be attended to, so that the tissue can dry quicker. Filter sensitizer always after use, and keep it fresh. See, also, remedies given in Paragraph 266.

268. **Failure.**—The highest lights dissolve out during development, but not the other parts of the print.

Cause.—Too long an exposure.

Remedy.—Add a few drops of liquid ammonia to the developing water. If the detail in the shadows do not then appear, another print must be made, giving shorter exposure.

269. **Failure.**—Dark spots or streaks are discernible on the print.

Cause.—Failure to blot off the excess of the sensitizing solution, rendering some parts more sensitive than others.

Remedy.—Be careful to blot off all superfluous sensitizer when squeegeeing the print.

270. **Failure.**—The prints have too hard or chalky appearance.

Cause.—Too weak a sensitizer, or too much ammonia added to the developing water.

Remedy.—Use a weak sensitizer—say one to two per cent. strength—for soft negatives, adding as much ammonia as will turn it to a pale yellow color. For strong negatives use a five per cent. solution with no ammonia.

271. **Failure.**—Print develops flat.

Cause.—The sensitizing solution has been made up too strong.

Remedy.—Same as for last.

272. **Failure.**—The print has a fairly good appearance, but the half-tones are eaten away.

Cause.—Development was started in water that was too hot, or the hot water was added during development; also caused by too much agitation of the water during development.

Remedy.—The temperature of the water should not be over 100° Fahr. Also avoid agitating the water too violently.

273. **Failure.**—The print shows slight reticulation.

Cause.—Too sudden a change in temperature of baths, or water too hot during development.

Remedy.—Raise temperature of developing baths gradually—not to exceed 100° to 105°.

274. **Failure.**—Shining round spots appear on the transferred print when the support is rough.

Cause.—The support was not left in the water bath long enough before transferring, or sufficient pressure was not applied when squeegeed.

Remedy.—Heavy rough transfer paper should be allowed to soak in clean water for from one-half to two hours before being squeegeed to the tissue. Also, they should be dipped in a bath of water at 110° just prior to being brought into contact with the tissue. Also, greater pressure should be applied during squeegeeing.

275. **Failure.**—Small shining points are visible on the outline of transfer prints.

Cause.—Due to too much air in the developing water, and also water too cold; also transfer paper not left long enough to soak in water.

Remedy.—Use warmer water for development and for soaking the transfer paper.

CHAPTER XI.

Carbon Process.

Part VIII.

The Double Transfer Process.

276. In the double transfer process there is little gained over the single transfer, as far as results are concerned. If anything, better results are obtained by the single transfer. The main object of the double transfer is to obtain unreversed prints. This process is more complicated, and it is recommended only in cases where the reversed image will not answer; for instance, in street scenes, landscapes and architectural pictures where the original positions should be preserved, and when you are printing from ordinary negatives. If special reversed negatives are made, the double transfer is unnecessary.

277. When printing from portrait negatives the change of the picture from right to left is of no consequence. We advise using the single transfer for portraiture, and the double transfer for only such work that must be photographed as the original appeared. The only change in the manipulation of the double over the single transfer is in an additional transfer from the second support, which is temporary instead of permanent, to a third or final support. Instead of using a permanent support in the single transfer, one on which the carbon becomes permanently attached, you use what is termed a temporary support. This support being used only to develop the image upon the surface, instead of being prepared with a tacky substance which holds the tissue or film fast, is prepared with a waxing solution, from which the image can be transferred to a final permanent support, prepared with a tacky substance.

278. The double transfer can be effected in two different ways: First, by using a flexible temporary support of paper, and second, by using plain ground-glass or opal. The flexible support may be obtained already prepared from the dealer, cut in regular size sheets, or the paper can be bought in full size sheets 18 x 23 inches and prepared by yourself. This support can be used several times, provided that it is thoroughly dried and waxed after each operation.

279. The waxing solution is prepared as follows:

Benzole	2 ozs.
Turpentine	2 ozs.
Beeswax	6 grs.
Resin	24 grs.

280. There are two methods that may be employed for waxing or preparing the support: First, by floating the support on a bath of waxing solution; second, by applying the wax with a soft flannel pad. This latter method is preferred, as it is more simple and requires less of the solution. When applying with the pad, first tack the flexible support by the four corners on some smooth surface board and rub it with the flannel pad moistened with the waxing solution. The rubbing must be done lightly and evenly, so as to effect a polish such as the paper had before applying waxing solution. Remove all lint, if any, from the surface before waxing is dry, as the support must be perfectly clean before the transfer is made.

281. The operation of this first (temporary) transfer and the development is identical with that of the single transfer process described in the previous chapter.

282. After having prepared your flexible support, as directed above, immerse it for a few minutes in a tray of cold water. At the same time immerse your carbon print in the same water. You can either place the flexible print under the carbon and bring the two in contact while in this cold water, and then withdraw from the water and lay on the squeegee plate, or you may lay your flexible print on your

squeegee plate, waxed side up, and then place the print on it face down. The method of bringing print and support in contact underneath the water is preferable, as there is less liability of air-bells or bubbles gathering between the carbon and transfer. Now, cover with the rubber cloth and squeegee into contact.

283. After the print and transfer are in contact, lay a dry blotter over the print and mop off all moisture, as the least drop of water will cause spots and the spots will cause blisters after the transfer is made. After thorough mopping, the prints are hung up to dry for say 15 or 20 minutes, when they are then ready for developing, which is done exactly the same as in the single transfer process. After the carbon is fully developed it is placed in the alum or hardening bath for 12 minutes, and then washed for half an hour, when it is ready to be transferred to the final support.

284. It is better to use powdered (potash) alum, which must be thoroughly dissolved before using, for the least undissolved particles coming in contact with the film will not only stain but scratch it. In order to prevent any undissolved particles in the bath, filter before using. This bath must be cold—never warm.

285. **The Second Transfer.**—Different grades of final paper supports can be purchased already prepared for use. If you prefer any special support, such as Whatman's paper, it must be coated with the following preparation:

A.

Gelatin	2 ozs.
Water	16 ozs.

B.

Chrome Alum	1 dr.
Water	2 ozs.

286. In an earthen or granite dish soak the two ounces of gelatin in the sixteen ounces of water, for from four to six hours; then dissolve by gentle heat. When

thoroughly dissolved, add 6 drams of B in four ounces of warm water. Stir the gelatin (A) constantly while adding the alum (B) diluted with warm water. Then filter, after which the solution is ready for use.

287. This preparation must be applied to the paper while warm and may be put on with a soft sponge; or the solution poured into a large tray and the paper floated on this the same as when coating the temporary support. The application with the sponge is the most simple, however, and therefore is recommended. After the paper is coated hang it up to dry, allowing the film to thoroughly harden. When dry and you are ready to make your double transfer, it is advisable to again coat the paper with this warm solution. Then place this prepared paper upon the image which has been developed upon the temporary support and squeegee into perfect contact. Finally hang it up to dry. When thoroughly dry, but not before, with the blade of a pen-knife separate the papers at one corner. Then take these corners, one in each hand, and separate the two pieces, one from the other.

288. As the ready-prepared second transfer paper (final support) can be purchased either in rolls or cut sheets from any dealer in photographic supplies, you will find it cheaper, and time saved, to purchase the support already prepared. When using the prepared stock one is apt to experience difficulty in determining which side of the paper is prepared, as both sides look alike when wet. It is advisable, therefore, before immersing the paper, to mark, with a pencil, on the outside of the roll, which is the back. This will enable you to easily distinguish the prepared from the plain side in subsequent operations. The face side is smooth and tacky, the back more gritty.

289. The final support should be trimmed as much larger than the temporary support as the temporary was larger than the carbon tissue.

290. Having cut the final supports to the required sizes, immerse them singly in clean water, 100° Fahr., the prepared side down. The immersion must be gentle, in



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order to avoid bubbles. If any of them appear, more especially on the prepared side, expel them with the camel's-hair brush, for wherever these bubbles appear they will prevent the paper from absorbing the moisture, and when the print is transferred to the support there will be blisters where these bubbles were not removed. Allow the sheet to remain in the water until it becomes semi-transparent, or thoroughly saturated, and the prepared side is covered with minute bubbles, which will appear in about three minutes. At this time the sheet must be withdrawn from the water (by taking hold of the two nearest corners) and placed on the carbon image, which has been previously placed face side up on the squeegee plate, or some smooth surface. Begin with the lower edge, gradually lowering until the whole is in contact; then cover the back with rubber cloth and apply the squeegee to expel all air bubbles and surplus moisture. After this is accomplished lay a dry blotter over the print and mop thoroughly, after which hang up to dry. When thoroughly dry, separate the two supports as previously instructed.

291. In order to save time, when there are many prints to transfer, instead of transferring them from the temporary support while the developed image is still wet, the prints may all be developed on the temporary support, fixed in the alum bath and washed in clean, cold water and hung up to dry. Any time after they are thoroughly dried they may be transferred to the final support. When ready to transfer, place one or two prints at a time in clear, cold water and allow them to remain until the paper is thoroughly soaked; then remove one of them to the squeegee plate, face up. Having previously cut the final supports to the required sizes, immerse a sheet in warm water, 100° Fahr., until the bubbles appear and the paper becomes semi-transparent. Next, place it upon the developed image, as previously described. Then carefully squeegee with considerable pressure in order to make an even transfer. After mopping off with a clean, dry blotter, hang up to dry, after which separate as previously instructed.

292. We recommend the drying of prints upon the temporary support before transferring to the second or final support, as this method is much safer.

293. **Note.**—The same care must be exercised in drying prints, both on temporary and final supports, as in drying the sensitized tissue. So far as dust is concerned, the room must be perfectly clean and free from dust or dampness.

294. **Squeegeeing.**—The squeegeeing must be done most carefully and a perfect contact must be obtained. The best way is to bring the tissue and temporary or final support together under the water, and then, with a gentle, but firm and even pressure, pass the squeegee down, commencing one-third from the top. Then turn the tissue and support around and repeat the operation in exactly the same manner. Always have a blotter handy to mop off water that lays on the edge of the squeegee plate. This squeegee plate and the table on which it rests must be free from dust or grit. It is advisable to wipe off the table carefully with a damp cloth before beginning your work. You cannot be too careful in observing cleanliness. The most satisfactory squeegee, even for large prints, is a flat rubber 6 inches in length and about $1\frac{1}{2}$ inches wide, and $\frac{1}{4}$ inch thick, set in wood.

295. **Care of Squeegee.**—It is essential that the squeegee should be thoroughly cleansed and dried after using, and kept in a clean place free from dust.

296. **Mounting the Prints.**—The greatest care must be exercised in mounting carbon prints, as the different colors of tissue require different colored mounts. There is but one color of mount that can be used for all colors of tissue, and that is pure white. There are, however, many pretty effects obtained by using suitable colors of mounts to harmonize with the color of tissue used. For an example, a sepia colored print is best mounted double—the first layer, with narrow margin of light cream, mounted on a dark brown. Black and white prints can be mounted first on white card, with narrow margin, and then on black or deep

gray. Sea-green is best mounted on white; reds or bright colors are best mounted on white or tints bearing on the color of tissue used, only of a lighter shade.

297. All carbon prints can be mounted solid, but are better mounted or tacked on the corners only. Never use fancy mounts, gold edges, lines, etc. When mounting solid, care must be exercised not to mar the surface of the print. Be sure to use perfectly dry blotters, free from lint or grit, and use a roller squeegee for rolling down.

CHAPTER XII.

Carbon Process.

Part IX.

Alternative Methods—Spirit Sensitizer, Etc.

298. In the previous chapters we have given methods and formulæ which, with practice and attention, will secure perfect results in carbon printing. There are various alternative methods which can be employed, provided the fundamental principles are understood, and many workers have favorite formulæ for sensitizing the tissue or for clearing it.

299. The most recent method of sensitizing paper tissue is by the use of what is called spirit sensitizer, which is supplied in liquid form, ready for use, and can be applied just before you are ready for printing.

300. The object of this spirit sensitizer is to get over the great delay caused by the prolonged drying under the usual methods of sensitizing in the ordinary bichromate bath. Using the spirit sensitizer, the worker can sensitize his tissue only a short time previous to his putting the tissue out to print. It is easy to see, therefore, that the use of such a sensitizer has very many advantages. It can be used on any carbon tissue, but is intended particularly for the Autotype tissue, and can be purchased from any dealer in photo supplies.

301. **Materials.**—The materials required for this method of sensitizing are few, only the sensitizer and sensitizing brush being required, outside of the materials listed in a previous chapter. The brush that comes with the spirit sensitizer can be used, or the worker can prepare one for himself, by wrapping a flannel cloth around a glass rod, the flannel being attached to the rod with rubber bands. Or, a stiff sheet of celluloid can be laid on a piece of flannel, the flannel brought over the ends of the celluloid, and

then the two ends of the celluloid folded together and held in a clip.

302. **Sensitizing.**—To sensitize the tissue take a couple heavy card mounts—or the cover of a plate-box will do—and pin the carbon tissue to it, face side up. This can be done in strong light. The sensitizing, however, must be done in a darkened room; one where velox can be handled safely will answer the purpose admirably. Take the bottle of spirit sensitizer and pour a little of the solution into a clean glass tumbler. Loosen the flannel on the glass rod or handle of the brush which accompanies the bottle, so that it overlaps the glass rod about half an inch. Dip it into the sensitizer, drain for a moment against the side of the glass, and then brush the carbon tissue with even strokes from side to side, allowing each stroke to overlap the previous one. This one coating will be found sufficient for most all work. However, if an extra strong print is desired the tissue may be brushed again in the opposite direction, care being taken that the brush is sufficiently wet; otherwise it will stick and cause streaks in the finished print.

303. The board with the carbon tissue pinned on it can be set in some dark corner to dry, and two or more sheets prepared while the first is drying, which does not take more than five or six minutes. After a few sheets have been sensitized the first ones will be dry and ready for printing. This is one of the greatest advantages of spirit sensitizer, for by the ordinary sensitizing with bichromate it is necessary to let the tissue dry for from five to eight hours.

304. After the tissue has been dried, the printing and transferring proceeds as in the instruction already given, with the exception that the temperature of the water when first starting to develop may be lower than when the regular bichromate bath is used.

305. **Note.**—Carbon tissue sensitized with the spirit sensitizer prints much faster than when the bichromate sensitizing is used, the average Pyro developed negative (one that is not too dense) requiring about one and a half

to two minutes to print in sunlight. In all cases of over-printing with this tissue, use hotter water for developing; in cases of under-printing the water must be kept quite cool.

306. Drying Tissue.—Some manufacturers make what is called a daylight tissue, in which the paper support has a non-actinic quality. Such carbon tissue, after sensitizing, can be squeegeed to ferrotype plates, and then placed on edge to dry, instead of being hung up in a drying-room. Tissue treated in this way dries flat, so that contact with the negative is readily assured. At the same time, it is kept away from the light and from fumes, etc., during the drying process, which is always a delicate stage of the work; consequently, many of the best workers prefer this method of drying their tissue.

307. Reversing Negatives to Obtain Non-Reversed Prints, by the Single Transfer Process.—As previously explained, the single transfer process yields reversed prints when made from an ordinary negative. If the print is made from a film negative, of course the print can be made through the back of the celluloid support, and then there will be no reversal of the image. Of course in portraiture, landscape or pictorial work, a reversal is of little importance, but still it is sometimes desirable to have the image the right side to. Where many prints have to be made off the one negative, some workers prefer to reverse the negative itself, rather than to go through the double transfer process with each print, as the double transfer process offers more chances for failure than the single transfer.

308. To reverse the film of a negative, it should first be hardened, for about five minutes, in a 10% solution of formalin, to which a few drops of glycerin have been added. The film can then be cut around through to the plate, about an eighth of an inch from the edge, and then placed in a bath made up of

Water10 ozs.

Hydrofluoric Acid1 dr.

This should be done in a rubber tray, as the hydrofluoric acid attacks glass or porcelain.

309. Rock the tray gently and the film will begin to loosen from the glass at the edges. Avoid placing your fingers in the solution. Place a piece of moistened, fluffless blotting-paper over the film and gradually lift it away from the plate. The film is then washed carefully, and next placed into a tray of clean water, into which a clean glass plate has been placed. It is best to flow this plate with a substratum of insoluble gelatin. The water will soften the gelatin, and then, with the negative film in the water, but reversed, the plate and film are squeegeed together and removed from the water, care being taken that no air-bells remain under the film.

CHAPTER XIII.

Part X.

Double Transfer from Plate, Opal or Ground-Glass.

310. The plate-glass is recommended where a brilliant surface is desired. The opal, or ground-glass, is recommended for very fine grain matt surface results.

311. **Preparing the Opal or Ground-glass.**—The opal, or ground-glass, has an advantage over the plate or transparent glass, from the fact that the development can be watched and examined, while on the latter the development is more difficult. If, however, a white porcelain tray is used, the development can be watched on plain glass just as well.

312. **Cleaning the Glass.**—The plate used for this purpose must be perfectly clear and clean. In order to insure clean plates we advise placing them in a carbonate potash bath, made as follows:

Water	32 ozs.
Carbonate of Potash	6 ozs.

313. Place this bath in a porcelain tray and immerse the plates for about three hours. If these plates have been previously used, they must remain in the carbonate potash bath until the wax is thoroughly dissolved. They should then be rubbed with a piece of flannel and finally rinsed in clean water, then placed in a rack to dry.

314. **Waxing the Glass.**—After the plates are thoroughly cleansed they must be prepared with a waxing solution, as follows:

Beeswax	20 grs.
Pure Benzole	4 ozs.

315. In order to dissolve the wax more quickly, it is advisable to warm the benzole. To do this, place the benzole and wax in a glass bottle and stand in a kettle of hot water. It will be necessary to renew the hot water

from time to time. You must be careful and not place near a stove or light of any kind, as the benzole is very inflammable and explosive, but there is no danger if you keep it away from fire. After the wax is dissolved it should be filtered and the clear solution used when preparing the plates.

316. Applying Wax Solution to the Opal, Ground-Glass or Plate Glass.—After you have carefully polished the surface of the plate it is intended to use, place it on a table, which is free from dampness and dust, and with a piece of flannel soaked with a small quantity of waxing solution, rub over the surface of the glass very quickly. Avoid going over the same spot twice, as this would give you an uneven waxing and also too much of it. Any number of plates may be prepared in this way and placed in a rack to dry. The drying requires about half to three quarters of an hour.

317. Preparing Plain Glass.—If a brilliant surface is desired, plain plate-glass must be used; and after waxing in the usual way, and just before using, the waxed surface should be polished with a dry flannel cloth, by rubbing lightly over the waxed surface. Any moisture coming in contact with the flannel or wax on the plate will ruin the surface. If only plain glass can be had and a matt surface is desired, the plain glass may be waxed and polished in the usual way, but as soon as polished must be flowed with plain collodion. This collodion may either be obtained from any stockhouse, or may be prepared as follows:

318. Collodion.—

Alcohol	16 ozs.
Ether	16 ozs.
Gun-cotton	3 drs.

Dissolve the gun-cotton in ether and then add the alcohol. Great care must be exercised in handling gun-cotton, as it is very explosive and must be kept away from fire.

319. This should be mixed in a three-pint bottle and kept in tightly corked bottles—glass stoppered preferred. Part of the stock should be filtered into another dry bottle,

ready for use. The plates being carefully dusted with a dry camel's-hair brush, are then flowed with the collodion, by holding the plate between the thumb and index finger, allowing it to rest upon the edge of second finger. With the right hand pour on a liberal quantity of the collodion, starting at the farthest corner from you, gradually tipping the plate so the collodion will spread evenly all over, and finally drain back into the bottle. Rock the plate gently from right to left. Then place the plate in the rack for a minute, or until the collodion sets, *not dries*. This will insure even coating.

320. Next, place the plate in clean water for fifteen to twenty minutes, as it is important that all the ether and alcohol be removed from the film. If any remained these liquids would cause spots and stains. We, therefore, advise rinsing all collodionized plates under the tap for a minute or so and finally set in the rack to dry.

321. **First Transfer on Glass.**—Into a good-sized tray, half filled with water, and made slightly alkaline by adding a few drops of liquid ammonia, immerse the printed tissue, exercising care in having the fingers perfectly dry when handling the dry tissue or stains will be formed on the surface. The air-bells as they arise on the face or back must be expelled with the camel's-hair brush. After a few minutes' immersion, turn the print face down and slide the collodionized plate under the print. Draw print in contact with glass while under the water. This will prevent air-bells gathering between print and glass. Keeping both together, carefully withdraw them from the water. Place the rubber cloth over the print and glass, and the squeegee into contact, expelling all the air and water. After the print is thoroughly squeegeed cover with a dry blotter, which will absorb all the moisture around the print, thus saving the print from curling during development. Several prints may be transferred before any are developed, and none should be developed unless they be allowed to stand for at least fifteen minutes after squeegeeing, when they are ready for development.

322. **Temperature of Room.**—Do not work in a cold room; the temperature should not be under 60° Fahr.

323. **Developing the Print.**—The development on glass is about the same as the flexible support. Place the glass bearing the tissue in a hot water bath of 100° to 110° Fahr., having the film side up. Spray the hot water over the film, continuing until the paper is washed off. Don't catch it by the corners, as in the case of flexible support, as the paper will wash off of its own accord in a very few minutes. When it becomes thoroughly loosened it can be removed without any pulling or injuring of the film. After the paper is removed, continue to spray the plate or keep it in motion under the water until the image becomes clear and clean. It is then placed in the alum bath and fixed for ten minutes. After fixing, the plate is again rinsed in cold water and placed in the rack to dry.

324. **Transferring from Glass to Final Support.**—For the final support, heavy-weight paper is recommended, or two thicknesses of the medium weight.

325. The glass bearing the dry image is placed in a tray of cold water for a few seconds, after which it is laid on a table or some flat surface. Then place a sheet of heavy support (or if medium support is used, use two sheets) in a hot water bath, 120° Fahr., face down. If any bubbles arise on back before the surface becomes semi-transparent, expel them with the camel's-hair brush which has been previously made wet. In from three to five minutes the paper will become transparent and covered with air-bubbles. At this stage, withdraw it from the hot water and apply the support to the glass, gelatin side in contact with the image. Now, cover with the rubber cloth, and with the squeegee expel all air-bubbles and water.

326. If the medium-weight paper is used, apply the second sheet over the first in a like manner, squeegeeing in perfect contact; then place in a rack to dry. When thoroughly dry, insert a knife point under one corner of the paper, when it will readily strip from the glass.

CHAPTER XIV.

Part XI.

Difficulties—Carbon Process, Double Transfer.

327. Prints Stained or Scratched.—If the print on the temporary support has been cleared in an alum bath in which the alum has not been entirely dissolved, the film of the print will become stained and scratched by the undissolved part of the alum coming in contact with it. The alum bath, in which powder potash alum should be used, should be filtered before use, and must be used cold.

328. Dark Specks on the Print Sometimes Surrounded by Round White Spots.—If the wash waters or any of the developing baths are made up of water containing iron, or small iron particles, small dark specks will be left on the face of the print. These can be picked out when the print is dry, and the print re-spotted. If the water you use from the tap is not clear or free from iron, filter as it comes from the tap.

329. Blisters on the Image.—These are caused by the air in the final support, which has not been properly soaked previous to squeegeeing to the tissue. There will be blisters wherever the air bubbles appear and are not removed. The final support should be allowed to remain in the water until it becomes semi-transparent or thoroughly saturated. Minute bubbles will appear on the prepared surface in about three minutes, all of which should be carefully removed.

330. Perfect contact between the support and the tissue can only be attained by thorough soaking of the support in water and heavy pressure of the squeegee when bringing the support and tissue together.

331. When Using Plain Glass for First Support, in Order to Obtain a Brilliant Surface, Portions of the Print Appear Dull.—If the glass used for the first, or temporary, support has not been thoroughly cleaned, it will be difficult to get an even coating of wax on it. The surface of the plate must be carefully polished, and the waxing solution rubbed over it very quickly and evenly, avoiding going over the same spot twice, as this would give uneven waxing and produce dull spots on the print. Any moisture coming

in contact with the waxing flannel, or with the wax on the plate, will ruin the brilliant surface of the print.

332. When Preparing Collodion, It Becomes Milky.—The collodion emulsion should be prepared in a bottle which is thoroughly dry. A good plan to dry out a bottle which has been washed is to pour in a little alcohol, rinse it around, and then pour out the alcohol, leaving the bottle to drain.

333. Unable to Coat the Glass Evenly.—Some little difficulty may be experienced in getting an even coating of collodion at first on the plate. The plate should be held on the tips of the thumb and first and second fingers, pouring the collodion on the corner farther from you, gradually tipping the plate so the collodion will spread evenly all over. The excess collodion should be drained back into the bottle. By rocking the plate slightly a perfectly even coating can be obtained, which will soon set.

334. Unable to Obtain a Matt Surface Effect when Using Plain Glass for a Support.—To obtain a matt effect with a plain glass the plate must first be waxed and polished, and then given a coating of plain collodion. The plate with the collodion coating must be placed in clean water for fifteen or twenty minutes, to remove all the ether or alcohol from the film. If either of these liquids remain they will cause spots and stains on the print.

335. Film Becomes Injured when Transferring the Print from Glass.—The film, or print, is at all times exceedingly delicate, and unless very great precautions are taken in all the transferring manipulations it is liable to become injured and torn. Also, the pressure of the squeegee when bringing the print into contact with the final support should be evenly applied.

CHAPTER XV.

Part XII.

Carbons on Watch and Cigarette Cases, Watch Dials, China, Ivory and Celluloid.

336. Many pretty and permanent effects can be obtained by transferring carbons onto watch dials, china, ivory and celluloid. The process of making the print is exactly the same as for regular carbon work, with the exception that the double transfer must be employed. The picture having been developed on a temporary support is then transferred to any of these articles.

337. For a temporary support, that used in the ordinary carbon process is too heavy and not sufficiently flexible. As it is so thick and unyielding it would be impossible to press it into sufficiently close contact on a convex surface (for instance, a watch case) to obtain a perfect transfer. Even on flat surfaces it is next to impossible to obtain perfect contact, as the print is generally very small. For this reason, it is necessary to use a flexible and yielding support.

338. There are two different supports, either of which will answer the purpose. These are of India rubber or film of collodion. We recommend the collodion support. The collodion support has advantage over the rubber support, because it is transparent and enables you to see any air-bells which might gather, and also better enables the placing of the picture in the proper position. However, we will describe the making of both of these supports.

339. **India Rubber Support.**—The India rubber support is prepared as follows: From a rubber store, obtain a can of India rubber solution. Thin this down with benzole to about the consistency of thin syrup. Place in a

tray large enough to float the paper. The paper must be very thin—the thinner the better—but it must be able to withstand the warm water in development. Float the paper on the rubber solution for a few minutes and then hang up to dry. It is advisable to prepare this paper a few days before you wish to use it, so as to be sure that all solvents in the rubber have evaporated. If any of the solvents remain they will cause stains and spots in your print.

340. This India rubber support is used in exactly the same manner as the ordinary temporary support. The exposed tissue is squeegeed upon it in the regular manner, and the same methods employed for developing, washing and drying. You should, however, abstain from using the alum bath, as this would be apt to harden the surface, thus preventing successful transfer to the desired article.

341. **Collodion Support.**—To prepare the collodion support procure an ordinary glass plate, a little larger than the support you intend using. Clean this thoroughly, and when perfectly dry, dust over the surface, on one side only, with French chalk. Then wipe carefully with a soft, dry cloth, so as to remove all the chalk visible. Enough of this chalk will remain, although it cannot be seen. Next, coat this glass, chalked side, with ordinary enamel collodion (according to the formula given in the double transfer chapter), to which has been added negative cotton in proportion of three grains to every ounce of collodion, so it will produce a thick film. To coat the glass, hold the plate at the lower left-hand corner, between the fore-finger and thumb, with the lower edge of the plate resting on the third finger. Start the collodion at the top right-hand corner, flowing evenly over the entire plate, and drain back into the bottle.

342. After the collodion has become set (not dried) on the glass, the glass is placed, coated side up, in a tray of water and allowed to soak for ten or fifteen minutes, then placed under the tap, allowing a steady stream of water to fall on it, to thoroughly free it of the solvents in the collodion. The exposed tissue is squeegeed on to this, then set

up to dry, and when dry can be stripped and trimmed in exactly the same manner as from the ordinary support.

343. The print is then ready for transferring to whatever article desired. After transferring, the collodion can be dissolved from the print with a mixture of one ounce of alcohol to one-half ounce of ether.

344. **Transferring on Watch-Case, Gold or Silver.**—First, take your watch to a jeweler and have the movement removed. He will take charge of same and keep it free from dust. Then have the part of the case upon which it is intended to transfer the picture cleaned thoroughly by rubbing with a soft cloth saturated with benzole, so as to remove all grease or dirt. Great care must be exercised not to scratch the surface, as every little scratch will show on the picture. In many cases it is advisable to have the jeweler buff or polish the case before you make the transfer.

345. Coat the side of the case upon which you are going to transfer the picture with the following solution:

Gelatin	1 oz.
Water	5 ozs.

Heat the water and dissolve the gelatin in it. When cool, add 3 grains of chrome alum dissolved in $\frac{1}{2}$ ounce of water. Apply this solution with a camel's-hair brush or a tuft of cotton.

346. After coating the case with the above solution, allow it to dry. While drying, trim your print neatly to the required size, and place it and the watch-case in cold water for fifteen minutes. Next, place the latter in warm water (testing 110° Fahr.), and allow it to remain there until the coated side feels slimy.

347. Take the print which you have previously marked as a guide to position (this marking is only necessary when the rubber support is used) and place it in the warm water, and bring the watch-case and print in perfect contact under the water, to prevent air-bells. Then withdraw from the water and with small pieces of blotting paper remove all surface water. With your pocket-handkerchief press print and case in perfect contact, gently rubbing from

the center with the fingers, to remove all superfluous water and any possible air-bells. Then allow it to dry thoroughly. Never hurry the drying.

348. When dry, moisten the back of the print with benzole, and in a minute or two the paper can be slipped off and the picture will remain firmly attached to the metal. If the rubber support has been used, and any of this remains on the picture, it can be removed by wiping with benzole. Where the collodion support has been used, the collodion can be removed from the print with the ether and alcohol solution.

CHAPTER XVI.

Part XIII.

Difficulties—Carbon Process.

349. **Preparing Sensitizing Bath.**—The sensitizing bath should be prepared exactly according to the directions given in the lesson. If the bichromate does not dissolve readily the water is too cold. Warm water (temperature not less than 110° Fahr.) should be used to dissolve the bichromate, and it must be thoroughly dissolved before being used. The bath, of course, must be cooled to the proper sensitizing temperature before placing any tissue in it, and should be filtered through cotton each time before using.

350. **Tissue Cracks when Unrolled.**—If the tissue is very hard and crisp—*i. e.*, exceptionally dried out—care must be exercised not to crack the surface of the pigment when straightening it out. It should be laid on a frame over a tray of water and covered with a blotter, and allowed to remain in this position for two or three hours, until it has taken up enough of the moisture to become slightly flexible. In this condition it will easily unroll or flatten out when placed in the sensitizing solution.

351. **Sensitizing the Tissue.**—Little or no difficulty should be experienced in sensitizing the carbon tissue. One edge should be inserted in the bath and the tissue gradually unrolled, at the same time thoroughly applying the solution to all parts with a camel's-hair brush. At the end of one minute the tissue will be thoroughly limp and should then be turned over. Brush the back of the paper for another minute, so as to have the solution penetrate this side evenly, and that all air-bells be removed. The tissue should now be turned over and the pigment side brushed carefully for the remainder of the time required to sensitize.

352. **Tissue Dissolves During Sensitizing.**—Should the tissue dissolve while sensitizing, and especially when touched with the fingers, the bichromate bath is too warm. It should not be warmer than 70° at most; a much lower temperature is advisable. In summer the sensitizing solution should be placed in an ice water bath; *i. e.*, the tray containing the sensitizing solution should be floated in a larger tray, which latter should contain water with a piece of ice in it. If this is not convenient the regular sensitizing tray should be cooled by allowing the water from the faucet to run into it for some little time, and if ice is available a small piece should

be allowed to stand in the tray for a few minutes before pouring in the sensitizing solution. The bottle containing the sensitizing solution may be easily cooled by placing it under the tap for some time, or setting it in a pail of ice water.

353. Drying Tissue.—If the tissue refuses to dry within the required length of time, the room in which you are attempting to dry it is too damp or too cold. The room should be perfectly dry and the temperature at such a degree that the tissue will dry in five or six hours. A specially arranged drying-box, which may be artificially heated, and a fan applied at one end so as to cause a thorough circulation of the air, will be a decided advantage over attempting to dry in a room, yet if but little carbon work is to be done good results will be secured if the room is at the proper temperature and perfectly dry.

354. Tissue Runs when Drying.—If the tissue runs during drying the drying-room is too warm. The room or drying-box must be kept about 75° Fahr., and at this temperature there should be a strong circulation of air, in order to insure rapid drying.

355. Judging when Print is Printed.—If the various directions given in the lesson have been followed, no difficulty should be experienced in judging the correct depth to which to print carbon tissue. The carbon does not require quite as much light action as the ordinary printing-out paper; it should be printed the same length of time required to make a good proof print from the same negative. The test for correct printing will come upon development.

356. Keeping Tissue Flat.—The best way to keep tissue flat is to place it under a sheet of plate glass, or put it in a dry plate box and weight it down with a sheet of glass. If a large printing-frame is at hand, a piece of plain glass may be inserted in it, a sheet of opaque paper placed on top of this, and the carbon tissue laid on next, the back of the printing frame being replaced and fastened.

357. Refusal of Tissue to Adhere to Support.—In this case the tissue has either been left in the water too long or has been exposed to foul air or gases during drying. Place tissue and support under heavy pressure for one hour and then begin development in moderately warm water. Add hotter water until the pigment begins to ooze out; then strip off the back, lower the temperature of the water, and proceed with development.

358. Exposed Parts of Pigment not Dissolving.—(a) First cause is due to too long drying; or fumes from the gas or lamp in the drying room. Always be sure that the room is well ventilated, and the room should be warmed without any danger of fumes emanating from the source of the heat. There must also be

a good circulation of air through the drying-box, if the latter is employed. (b) Another difficulty may arise from the bichromate bath having turned brown both before and after use. This bath should be filtered, and frequently renewed. (c) Still a third difficulty may arise from the tissue not being printed soon enough after sensitizing. Endeavor to sensitize so that printing can be done the same day, or at latest, the day following. It is often convenient to sensitize the tissue in the evening for use the next day.

359. Cannot Dissolve Pigment in Shadows.—The tissue is over-exposed. To secure the best possible results the temperature of the developing water should be constantly increased or a little ammonia may be added. If the details do not then appear a shorter exposure is the only remedy.

360. Image will Not Dissolve at All.—If even at the increased temperature the image refuses to dissolve in the developing water, the picture has been completely over-exposed. The only remedy is to make another print, giving a shorter exposure.

361. Frilling of Edge of Tissue during Development.—The tissue was left too long in the water before the transfer was made, or the superfluous moisture on the edge of the support was not blotted off after transfer.

362. Half-Tones Motley and Uneven.—If in the finest half-tones there appear transparent or only partly opaque spots, generally round, of varying sizes, and not close together, there has been a crystallization of the bichromate solution, through the use of too strong a solution. The difficulty may also occur if the tissue is sensitized too long and followed by insufficient superficial drying of the solution. The remedy is to employ weaker sensitizing baths, and after sensitizing, clean blotting paper should be applied to the film, or the film drawn carefully over the edge of the sensitizing tray two or three times, in order to remove all excess solution. Two or three minutes sensitizing is sufficient.

363. Dark Spots or Streaks on Prints.—This is caused by excess of bichromate solution and uneven drying, so that greater sensitiveness is produced in different places. Excess of sensitizer should be removed by drawing over the edge of the tray, squeegeeing the tissue on glass, or by blotting off the pigment surface.

364. Print Hard.—The sensitizer is too weak or contains too much ammonia, or has been dried too quickly.

365. Print Flat.—Sensitizer is too strong. For soft negatives a weak sensitizer of 1 to 3 per cent. should be used, with enough ammonia to turn it straw color. For hard negatives 4 to 5 per cent. should be used, without ammonia.

366. Half-Tones Eaten Away.—Should the half-tones dissolve away quickly, yet the balance of the print appear fairly strong, the

developing water is too hot, or too hot water was poured on the film. This difficulty is also caused by strong agitation of the water during development. The developing water seldom need exceed 85° to 100° Fahr. The print should be allowed to develop gradually and strong agitation avoided. If the difficulty occurs after having observed these precautions, the negative will require a paper sensitized with a strong solution.

367. Blisters.—Blisters are of two kinds—large and small. Those due to air on the surface or to air in the substance of the paper are usually small, but large blisters sometimes occur, so large and so numerous that almost half of the print will come away from the support. These may usually be traced to the tissue rather than to transfer paper; over-printing; printing in the sun or too near an arc lamp, so that the tissue becomes partially insoluble from the action of heat; stale tissue; tissue dried in a room with impure atmosphere; any of these produce surface insolubility and prevent satisfactory adhesion of tissue to the transfer paper, resulting in blisters.

368. Blisters will sometimes occur where there are large areas of heavy shadow, especially if the negative is too strong, and very full printing has been necessary to secure detail in the highlights. In the last instance the remedy is obvious—softer negatives must be produced and the existing negative either reduced with persulphate, or the shadows softened by the aid of stumping sauce applied to the back of the negative. In the other cases avoid heating the tissue during printing, and be careful to use only tissue which, before printing, is in a perfect condition of solubility. This point may be readily tested by slipping a bit of the tissue into water of 85° to 90° Fahr., when the gelatin should melt quite freely within a half minute. If it does not melt throw the tissue away. During the process of developing—in fact at all stages of the work—the tissue should not be subjected to sudden changes of temperature, as placing the tissue first in a cold bath and then in a warm one, or vice versa, will invariably cause blisters, and sometimes reticulation.

369. Slight Reticulation while Developing.—Reticulation, or the covering of the tissue with a network of small lines, is usually caused by water too hot, or by a too sudden change in the temperature of the water in developing. The remedy is obvious. To avoid reticulation in summer add 100 grains of salicylic acid to the 100-ounce bath of bichromate.

370. Picture Covered with Shiny Round Spots.—Caused by air being imprisoned between the tissue and the support—especially if rough paper is used. The transfer paper (etching paper, etc.) should be soaked in water for from one-half to two hours, accord-

ing to its thickness, and just before the transfer, dipped into water at 110° Fahr. Considerable pressure with a soft support should be applied in a copying press, or under a fairly heavy weight, after transferring.

371. Innumerable Bright Spots Appear on Outlines of the Transferred Print.—The water used for soaking the transfer paper was too cold and too full of air, or the paper was insufficiently soaked. Use warmer soaking water, and apply strong pressure on the print when transferring.

CHAPTER XVII.

The Ozobrome Process.

372. **Introduction.**—Ozobrome may be described as a simplification of the carbon process. The result obtained is a true pigment or carbon print, produced by a chemical process instead of by the direct action of the light.

373. Any class of negatives may be used for making the print or enlargement, as the numerous grades of bromide and developing-out papers make it an easy matter to produce either soft or contrasty effects at will.

374. The use of enlargements does away with the trouble and expense of making enlarged negatives.

375. Ozobrome prints, with a choice of twelve colors, can be made either upon the original print or transferred to any suitable surface. The image is not reversed, making double transfer a thing of the past. A number of prints in Ozobrome can be made from one print without the use of a negative, and the original print may still be retained unimpaired.

376. **Materials Required.**—A thoroughly fixed (in plain hypo), washed and dried print on bromide or developing-out paper, a sheet of Ozobrome Pigment Tissue (for method No. 2 provide also a sheet of Ozobrome Transfer Paper), and a package of Ozobrome Sensitizing Powder. Also provide a porcelain tray of proper size, for sensitizing (ordinary trays may be used for washing and fixing), a thermometer, a flat squeegee and a package of chemically pure blotters.

377. The print should be hardened by a five minute immersion in a ten per cent. solution of formalin, or for ten minutes in a four per cent. solution of chrome alum, washed twenty minutes, then dried. The hypo must be

thoroughly eliminated from the prints to be used for this purpose.

378. Toned or redeveloped prints do not afford the best results. When the transfer process (No. 2) is to be employed, a good strong paper with a fairly smooth surface, should be selected, as the prints will have to undergo a little wear and tear.

379. *Note.*—It is very necessary that the prints used for this process be fixed in plain hypo, as an acid bath will have a tendency to produce a flat print when finished.

The Non-Transfer Process. (No. 1.)

380. *Working Instructions.*—In this process the original print forms the support of the picture and consequently can be used but once, but as it is much easier and quicker than the transfer process, it will be the one generally adopted.

381. *Theory of Process.*—In the carbon process the tissue is sensitized by the immersion in a solution of bichromate of potash, which, when dried and subjected to the influence of light passed through a negative, causes the gelatin of the tissue to become insoluble in the proportion to which it has been acted upon by the light. The action of light changes the bichromate of potash into a chromic salt, which has the property of rendering the gelatin insoluble. In Ozobrome, this change is not brought about by the action of light, but by a chemical action, thus doing away with the exposure of the tissue under a negative. Having provided the required materials, the method of procedure is as follows:

382. Provide an amber-colored bottle, holding twenty ounces; then dissolve the contents of one tube of Ozobrome Sensitizing Powder in 20 ounces of water. When dissolved pour into the amber bottle and see that it is well stoppered. This solution will keep in good condition for about 48 hours. The sensitizing solution is to be used as described in the following instruction. Having at hand the print and



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sheet of pigment tissue of the desired color, proceed as follows:

383. Pour into a porcelain tray of proper size the required amount of sensitizing solution (about 10 ounces for a 10 x 12 tray) which is adequate for two sheets of the pigment tissue. If the tissue curls before immersing in the solution, bring the back of the tissue in contact with the solution, unrolling it gently until the entire surface of both sides is wet. The tissue will soon straighten out and in three minutes become perfectly limp and should then be removed from the solution. *Care should be exercised to prevent the formation of air-bells on either side of the tissue, while immersed in the sensitizing bath.* The bath should be discarded after two pieces of the tissue have been immersed.

384. **Temperature.**—It is important that the temperature of the sensitizing solution does not exceed 65° Fahr.

385. **Placing Print and Tissue in Contact.**—Provide a tray containing clear, cold water, into which place the bromide print and allow it to remain until it becomes thoroughly limp. Next, remove the print from the tray of water and place it face up on a ferrotype plate or sheet of glass, which should be as level as possible. Pour sufficient clear, cold water over the face of the print to remove all air-bells that may have collected, and examine carefully to see that none remain on the surface of the print. The sheet of pigment tissue should now be removed from the sensitizing solution, drawing it over the edge of the tray as quickly as possible to remove surplus solution, and then bringing it into contact with the print. Commence at one edge and lay the print down quickly. When in position, go over the back of the tissue with a squeegee or print roller to insure perfect contact.

386. It will be found a great convenience to provide a piece of ordinary table oil-cloth upon which to place the sheet of pigment tissue, face up, before bringing into contact with the print. The back of the tissue will adhere to the oil-cloth during the operation of laying it on the print, and will serve as a protection for the tissue when going over

it with the squeegee or print roller. The print and tissue must not slip during the operation of squeegeeing into contact, or a double image will result.

387. **Development.**—When contact has been secured, place tissue and print between dampened blotters to await development. Up to this point the process is the same for either the transfer or non-transfer process. After the print and tissue have been in contact twenty minutes, remove to a tray containing clear water of a temperature of 105° Fahr. In a few moments the pigment will begin to ooze from the edge of the print.

388. The paper backing of the pigment tissue should now be removed from the tissue with a steady, unbroken pull on one corner, leaving the print in the water and discarding the removed tissue backing. Allow the print to remain in the warm water, face down, until all of the soluble gelatin and coloring matter have been removed. The print may be gently raised from the warm water from time to time, to facilitate the removal of the soluble pigment by draining. *Care should be taken to avoid the collecting of air-bells on either side of the print during immersion.*

389. After the print has been freed from all the soluble gelatin, it should be removed to a tray of clear water of about the same temperature as the developing water (105° Fahr.), and allowed to remain for about ten minutes to clear up the last traces of soluble gelatin pigment.

390. **Removal of Silver Image.**—The print is next rinsed in cold water and placed in the following bath, which removes the silver image under the pigment image. Make up two separate solutions:

A.

Hypo	1 oz.
Water	10 ozs.

B.

Potass. Ferricyanide	½ oz.
Water	5 ozs.

391. Place the print in a solution composed of A, and as much of B as will color the solution a strong yellow color. Allow the print to remain in this bath ten minutes, or until all the black patchiness has disappeared. After the underlying image is thoroughly bleached out, the print should be washed in running water for fifteen minutes, to remove all traces of the reducing solution, and then suspended to dry.

The Transfer Process. (No. 2.)

392. In this process the image impressed upon the pigment tissue by contact with the print is transferred to another support, leaving the original print available for further transfers, when re-developed, as described later herein.

393. In the transfer process *cold* water is used instead of hot for separating the tissue from the print.

394. **Manipulation for Transfer Process.**—Having provided the necessary materials as instructed under the heading of “Materials Required,” proceed as follows: Place a sheet of transfer paper a little larger than the print to be used, face upward, in a dish of clear, cold water, and allow it to soak two minutes for smooth paper and ten minutes for thick, rough paper. Next, take the adhering sheet of sensitized pigment tissue and the print (prepared as instructed for the Non-Transfer Process), and immerse in the same tray. After a few seconds’ soaking, the paper may be easily separated from the print by a steady pull from one corner.

395. **Note.**—In this case the pigment gelatin of the tissue will adhere to its own support, leaving the print uncovered and changed from black to a light brown color. The pigment tissue now represents the exposed tissue in ordinary carbon printing, with the immense advantage that the image is reversed as regards right and left, thus securing an unreversed picture by a single transfer.

396. Place the print in a tray of cold water prepara-

tory to re-development, retaining the sheet of pigment tissue in your hand while examining the transfer paper for air-bells, which are likely to accumulate after the operation of stripping. After having removed any air-bells on the transfer paper by brushing with a large camel's-hair brush, bring the surfaces of the pigment tissue and transfer paper together under the water; then lift them out, clinging together, and lay them upon some smooth, hard surface, such as a sheet of plate glass, and squeegee them into contact with a flat squeegee.

397. Next, place them between blotters under moderate pressure; a sheet of thick plate-glass makes an excellent weight for the purpose. At the expiration of twenty minutes, development may be accomplished as described in the Non-Transfer Method.

398. **Mounting.**—After the print is dry it should be placed on a flat, smooth surface, face down, and the back moistened with water (applied with a soft sponge or tuft of cotton) until the print has become limp. *Care should be taken that the water does not reach the face of the print.* The back may then be covered with paste and the prints mounted in the usual manner.

399. **How to Re-Develop a Print that has been Used for the Transfer Process.**—After the print has been separated from the sheet of pigment tissue it should be washed for fifteen minutes in running water and then re-developed in any developer suitable for bromide or developing-out paper as the case may be. Continue development until the image changes to deep black; then wash for twenty minutes in running water.

400. The developer should be of full strength and preferably without bromide; allow the print to remain in the developer for several minutes after it has assumed a good deep black. It is impossible to over-develop. The re-development may be accomplished in daylight and no fixing is necessary. The print is now restored to its original condition and efficiency, and may be used again for printing after drying.

401. With care, as many Ozobrome pictures can be made from one print as the strength and substance of the paper base will allow.

402. **Modifying the Carbon Picture.**—*To Increase Depth and Contrast* add two or three drops of glacial acetic acid to each ounce of concentrated solution contained in the sensitizing bath.

403. *To Soften Contrast and Retain Delicate Detail* add fifteen to twenty minims of 5 per cent. solution of ordinary alum to each ounce of concentrated solution contained in the sensitive bath.

404. In the Non-Transfer Method, the bleached image underlying the picture in carbon may be re-developed partially or entirely, and this may be made use of in various ways. For instance, a weak print may be converted into a strong print by re-development.

405. If a weak developer be applied with a brush, local intensification may be affected. A weak sky may be made heavier or other portions increased in strength, while the remainder of the bromide image may be eliminated by a 10 per cent. hypo bath. The underlying image may also be toned by the various methods advised for bromide or developing papers. After such re-development, or toning, the solution must be removed from the print by fifteen minutes' washing in running water.

CHAPTER XVIII.

Difficulties—Ozobrome Process.

406. **The Image Uneven.**—When the image is uneven and the pigment appears to adhere only in patches, the cause is due to failure to immerse the pigment in clean water before pressing it into contact with the bromide print. Both the pigment tissue and the bromide print should be brought into contact beneath the surface of the water.

407. **Image Lacks Detail.**—When the image lacks detail, especially in the higher tones or the high-light of a print, the difficulty is due to one of two errors in manipulation. *First*, an excess of sensitizing solution remaining on the surface of the tissue and its getting upon the image before the two surfaces are squeegeed into close contact. Before bringing the pigment and the bromide print into contact, remove all superfluous sensitizing solution from the surface of the tissue by drawing the surface of the tissue once or twice along the edge of the tray. The *second* difficulty arises from the sensitizing solution being too strong for certain colors. For average work the proportion given by manufacturers (1 to 4) is correct. When using black tissue have a strength 1 to 3, and for lighter colors 1 to 5 or 1 to 6.

408. **Flat Pictures and Pictures Difficult to Develop.**—The usual cause is hypo remaining in the bromide print. The greatest care should always be exercised in thoroughly fixing in the plain hypo bath and then washing thoroughly in clear water the bromide print that is intended to be employed in the Ozobrome process. Difficult development may also be caused by allowing the pigment tissue to remain too long in contact with the bromide print and transfer paper.

409. **Specks and Air-Bells.**—At all stages of the process great care must be exercised to avoid air-bells and if they form, immediately remove them. Bear in mind that all surfaces should be brought into contact only under water or with a layer of water between them, and it is very important that the water itself should be absolutely free from air-bells. Special caution is necessary when employing the transferring process, as you must look out for air-bells after stripping the tissue from the bromide print. The transfer paper lying in the same dish with the tissue is very apt to

cause air-bells which emanate from the transfer paper to adhere to the tissue and thus cause trouble. The transfer paper should be soaked in a tray of water by itself, and when extra heavy paper is employed considerable soaking is necessary in order to remove all air that is in the paper. The heaviest transfer paper, and especially the etching paper, should soak at least one-half hour before using. It is an excellent plan to have a separate tray for each process, and then no serious difficulty will result.

410. Water used must be free from grit or any small particles of dirt, as these have a very annoying habit of coming in contact with the surface of the tissue and adhering, causing specks on the resulting print. *Cleanliness*, therefore, is the preventative and if a difficulty does occur, spotting is the only remedy. Another cause for air-bells is lack of squeegeeing or bringing into perfect contact the pigment tissue and the bromide print. All air must be excluded from between these two surfaces. If, however, the tissue and the bromide print were brought into contact beneath the surface of the water, air-bells cannot get between them.

411. **Frilling.**—There are four causes for this difficulty, as follows:

412. (a) *The use of a tissue smaller than the print* will almost invariably cause the frilling at the edges, on account of the edge not adhering to the bromide print or transfer paper. In every case the pigment tissue should be larger than the print you wish to reproduce.

413. (b) *Tissue too wet before transferring operation.* The amount of necessary soaking can only be ascertained properly by experience. If the tissue is saturated with water at this stage of the process it will fail to adhere firmly to the transfer paper. With very rough paper, lack of pressure after it is transferred, or insufficient time between the transferring and the development, may give rise to the same trouble.

414. (c) *Development taking place too soon after the squeegeeing operation.* If other instruction has been followed the print should remain 20 minutes after squeegeeing before development.

415. (d) *Insufficient squeegeeing.* The squeegee should be used firmly, but not roughly. Firm, even pressure should be cultivated, but great care must be exercised not to strike any portion of the print when bringing the squeegee into contact with it, as lines are apt to be formed when this is done.

CHAPTER XIX.

GUM-BICHROMATE PROCESS.

416. The gum-bichromate process excels all known photographic printing processes in cheapness, simplicity and artistic interest. Its greatest achievements are to be found in the work of the advanced amateurs of all countries, yet it is a process which will give infinite pleasure and instruction to even the beginner. It has frequently been stated that no one without the skill of an artist should attempt this process, and, in truth, this is so where any attempt at "*manipulating*" the print is made. But as a reproductive process, capable of rendering a picture in broad tones, yet with sufficient detail, and in any desirable color, it is worthy of being known and worked by every photographer.

417. It is, further, a process which is much made use of by more pictorially inclined professional photographers, and it has this essential charm about it, that when any hand work is done on the print itself it is almost impossible to achieve exactly the same result in any two prints from the same negative. There is thus a forced individuality about such prints which no other process can equal.

418. **What the Gum-Bichromate Process Is.** The Gum-Bichromate Process is a contact method of printing in any color, on any paper, from any class of negative, by means of the action of light on a pigment contained in a gum or other colloid coating on paper which has been made sensitive by a solution of bichromate of potassium or bichromate of ammonium or both.

419. **Its Limitations.** That there are certain crudities in such a process can readily be understood. For

instance, while it is entirely possible to obtain a bichromate image showing almost the complete detail of a fine negative, yet it is most difficult to obtain such a print, and besides, it is not the province of the gum-bichromate print to compete with a gelatin surfaced picture in liness.

420. Again, the surface of the image when the print is in the developing water is of such a nature that the least careless handling will mar the print, or remove color from some spot where it is not desired that color should be removed.

421. Again, if the worker attempts to manipulate the print in the developing water, and is not skilful in the use of his simple tools, or has not any clear idea of what he wishes to produce or alter, or is without some little training in drawing, the results will be generally inartistic, if not actually false to nature.

422. **Results Obtainable.** Given, however, a certain knowledge of drawing, and with a clear idea of the result required, the gum-bichromate process in the hands of a skilful worker will give prints that are not to be equalled for breadth, atmospheric effect, pictorial and artistic quality. The foremost workers of the world have for years made the gum-bichromate process particularly their own, and while many classify it as a splodgy, mussy, non-photographic process, it cannot be denied that it lends the photographer those elements of individuality which are not nearly so prominent in other printing processes.

423. **The Nature of the Process.**—A gum-bichromate print is the result of the action of light in varying degrees on a thin surface of some sensitized colloid, such, for instance, as gum arabic. Other similar materials can be used, but gum arabic is the simplest and more generally employed. Such a substance when sensitized with bichromate of potassium or bichromate of ammonium becomes insoluble when subjected to light, the degree of insolubility varying according to the strength of light; consequently, with such a substance spread on a sheet of paper and placed under a nega-

tive, varying degrees of insolubility are produced, those parts of the coated paper under the dense parts of the negative being entirely soluble, owing to their having received no action of the light, while those parts under the clear glass of the negative will be entirely insoluble from having received the full strength of the light.

424. If, now, a pigment or a carbon in a finely powdered state be mixed with the gum solution, it follows that this pigment will be soluble or insoluble in the same proportion as the gum, for the pigment, present in the gum in a finely powdered state, will dissolve away in the same proportion as the gum solution. When such a pigmented piece of paper has been printed and developed in water, and the soluble and semi-soluble parts washed out, a picture will be left, which will consist entirely of pigment, and as carbon and most other pigments are permanent, a permanent picture is produced on the paper, similar in quality to the material left on a sheet of paper in a water color painting.

425. **The Process in Detail.** While almost any kind of paper can be used, such a paper should be chosen as is thoroughly well sized; otherwise the coloring material will sink into the pores of the paper and it will be difficult to obtain clear high-lights. The coloring material or pigment is mixed in proper proportions with a solution of gum arabic and bichromate of potassium. This solution is spread evenly upon a sheet of paper, which is then dried in the dark. In its wet state the coated paper is not sensitive to the light, but becomes sensitive when dry. When the paper is bone dry it is in condition for printing, and can then be placed back of a negative and placed into a strong light, according to the density of the negative—direct sunlight for a strong negative, diffused light for a weak negative.

426. With certain colors a faint image is visible on the paper. With other colors no image at all is visible; consequently it is advisable to print with an actinometer. However, this is not entirely necessary, as the process has tremendous latitude. An under-exposed print may develop

out in cold water in ten or fifteen minutes, or less, leaving a coarse grained image. An over-exposed print may require to be left in the developing water for several hours, or the process may be hastened by the application of hot water; or, the hot water may be poured onto the print from a distance, or a soft brush may be used to bring out the image, if over-exposed. Thus there is little chance of losing a print unless it is very badly over-exposed or under-exposed. After development in water the print can be cleared in alum or sulphite of soda, and then hung up to dry, when it is finished.

427. Materials Required. The materials required are few and inexpensive. A few sheets of paper, some clean blotters, an ounce of gum arabic, an ounce of bichromate of potassium crystals, and a few tubes of water color or a small quantity of dry powdered colors. These are all the materials required for the preparation of a considerable number of prints.

428. Apparatus Required. Either a sheet of glass and a palette-knife, obtainable at any art store, should be provided, or a small pestle and mortar of glass or porcelain; one or two gutta-percha-bound bristle brushes, say of two-inch width, and besides these brushes a long Badger hair brush, of three or four inch width, which is styled a blender, the use of which will be described later. The Badger hair blender can be obtained at art stores or brush stores, and will generally cost about thirty-five cents per inch length. A camel's-hair brush is too soft for the purpose, and a bristle brush will not serve for blending the coating on the paper.

429. Large trays for developing should be at hand, and these can readily be made by the worker himself, out of shallow wooden boxes, lined with black or white oilcloth. A flat drawing-board, or pastry board, is very convenient on which to lay the print during development when special work is being done on the print. A long rubber hose, to attach to the faucet of the sink, is serviceable for manipulative work on the print during development. A package of push pins, or thumb tacks, to keep the paper taut during coating, is also advisable.

430. The Most Suitable Colors. For first work in the gum-bichromate process it is best to keep to a few colors, such, for instance, as lamp black, ivory black, Vandyke brown, Indian red, Hooker's green, burnt sienna, and some good blue color. Some workers use moist water colors in tubes, such as Winsor & Newton's, but a cheaper grade of tube can be employed without any disadvantages. Other workers prefer the dry powdered colors,

obtainable at a paint shop. These can be bought, according to the color, from a few cents per ounce up, and a half ounce each of the colors necessary will last a very long while. Dry powdered colors should be put in little glass jars and properly labeled. A black coating is generally made up of a mixture of ivory black and lamp black, which gives more body than either one of these colors taken alone. The addition of a little Vandyke brown gives a warm black, and from there on the color can be changed to suit by the addition of Vandyke brown and a little red or other color. The color is largely a matter of individual choice.

431. **The Best Papers for Use.** Almost any kind of paper can be used for the gum-bichromate process, provided it is well sized, so that the coating stays on the surface and is readily removable in the developer. If the paper is porous the coating will sink in, and it will be impossible to obtain clear high-lights, as the color will stay in the paper. Any good water-color paper is recommended, such as Michallet, Lalanne, etc., and these can be obtained at art stores, for a few cents a sheet. Papers with a slight grain on the surface should be used at first, as it is easier to coat such papers evenly than a perfectly smooth paper.

When the worker has gained some skill in coating, and desires to obtain a finely detailed print, then smooth bond papers may be used. For rough effects Whatman's papers, which should be first sized, give excellent results. Tinted papers are often used for special results.

432. **Preparing Solutions.** The simplest formula for gum bichromate printing calls for a solution of gum arabic and a solution of bichromate of potassium, with the addition to these two of a little coloring matter and good results can be obtained with just these three ingredients. The gum arabic, which can be bought at any drug store for five cents an ounce, should first be finely powdered with the pestle in a mortar; or if that is not at hand the gum can be put between heavy sheets of paper, or in a small linen bag, and pounded fine with a hammer. The object of reducing the gum to fine powder is to enable it to dissolve quicker. Place five ounces of water in a wide mouthed bottle, and then add the powdered gum gradually to the water, stirring vigorously. Or, the gum may be poured into the water and left to dissolve for a couple of days, the bottle being shaken now and then. When thoroughly dissolved it should be strained through muslin, to remove any impurities.

433. Such a solution of gum arabic will not keep in very good condition after a couple of weeks. A mold will begin to form on the surface and it will sour and grow thin, but this can be prevented by adding a little salisylic acid to the solution, which will tend to preserve it. However, as it is inexpensive it is best to make it up fresh every now and then, or each time gum-bichromate prints are to be made. The ounce of bichromate of potassium crystals is dissolved in ten ounces of water, which makes a saturated solution. Bichromate of potassium is poisonous, and the worker should keep his hands out of the solution. The bichromate solution should also be strained or filtered through a wad of cotton.

Formula.—

Gum Solution	1 oz.
Potassium Bichromate (Saturated Sol.) ..	1 oz.
Pigment Black	24 grs.
Or Pigment Red	40 grs.

Note.—Bichromate of ammonium may be used in place of potassium.

434. **Sizing the Paper.**—If the worker is not satisfied that the paper he is going to use is well sized, it is best to make a test. This can be done by mixing up a small quantity of bichromate, gum solution and a little color, and applying it with a brush to a strip of paper. Let it dry in the dark, and when dry immerse it in cold water. If after a time the color comes off entirely, leaving the paper pure white, the paper is suitable for coating. If, however, a color stain is left on the paper, which cannot be washed out, it is proof that the paper is not sufficiently sized.

435. To size paper prepare a sizing solution consisting of 31 grains of arrow-root in 1 quart of water. Bring the water first to a boil, then add the small quantity of arrow-root. Set to cool and then place in a bottle. Apply the sizing to the paper with a flat brush. One or two coatings should be sufficient. A weak gelatin size can be given to the paper by dissolving in a suitable vessel or bottle, 90

grains of Nelson's Gelatin No. 1 in 10 oz. of water. The gelatin should be allowed to swell in the water first, and then dissolved by placing the vessel containing the gelatin in a dish of hot water. An ounce of alcohol can then be added. This gelatin size is applied to the surface of the paper in the same way as the arrow-root size.

436. **Choice of Two Methods.**—There are two methods of preparing the sensitized paper. In the first the paper is brushed over with the bichromate solution, or immersed in it, and hung up to dry, then stored away in the dark, the gum and pigment mixture being added later. In the other method the gum and color are added to the bichromate solution and the paper coated in one operation. This method is advisable for the beginner.

437. **Method No. 1.** In a room that is slightly darkened stretch a sheet of paper over a clean blotter on a board or table. Hold the paper down at the corners by push pins or thumb tacks. Pour a small quantity of your bichromate solution in a saucer or graduate, and with a bristle brush apply it over the surface of the paper, covering it thoroughly and evenly. The stroke should be applied from right to left, across the paper, then up and down and across. As each sheet of paper is sensitized hang it up to dry by little wooden clips, or over a string stretched across the room. When such sensitized paper is desired for use, prepare a mixture of gum solution and pigment, in about the following proportion: Pour half an ounce of gum solution on your glass plate, and then add as much lamp black as will cover a ten cent piece. Also add the same quantity of ivory black.

438. With your palette-knife mix the gum and color intimately. If tube colors are being used, squeeze out about one-half inch of color of each of the lamp black and ivory black. When the solution is thoroughly mixed it should be of somewhat denser consistency than water, but should not be too thick, as it will be difficult to coat on to the paper. If too thin the image will be thin and weak. If you find the

mixture is too thick, you can thin it by adding a little water, or if too thin, you can add a little gum solution and some more color. With your second bristle brush apply this color to a sheet of the previously sensitized paper in the following manner: Take a sheet of paper somewhat larger than the size of print you desire to have. Stretch it on a board with push pins, having the push pins on the right-hand side inserted loosely, so that when the paper buckles (as it will when the solution is applied) it can be quickly drawn out tight again.

439. With your bristle brush full of color apply the mixture to the center of the sheet of paper, then with quick strokes, spread it right and left and up and down. This must be done quickly, as the mixture sets very rapidly, and once it is set all hope of even blending is gone. As soon as the color has been applied to the sheet, take up your blending or spreading brush and, holding it perpendicularly in your hand, pass lightly over the surface of the color, from right to left, up and down, and from corner to corner, as quickly as possible, dragging the points of the brush over the color, which helps to blend the bristle brush strokes.

440. Some little practice will be required to obtain a perfect, even coating. The moment that you see the blender beginning to make streaks in the color you must stop blending, for the more you blend the more streaky the coating will become, and these streaks will show in the finished print. The whole secret of good results in gum-bichromate printing is in the laying of the color on the paper, the thickness of the color, and the even blending; therefore, as both paper and coloring matter are inexpensive, it is a good plan to acquire a little experience in coating and blending color on paper.

441. **Method No. 2.**—This method is the one advised for the beginner. First prepare your combined sensitizing and coating mixture. For this purpose pour half an ounce of gum and half an ounce of bichromate solution on the glass plate, and add the amount of color given in the pre-

vious paragraphs. It will be found later, that certain colors require to be used in larger quantities than others, in order to obtain the correct thickness of coating. Blend the mixture thoroughly on the plate, by using the palette-knife. It is better to use a small mortar and pestle, grinding up the solutions and the color until a perfectly smooth mixture is obtained.

442. If of the right consistency the mixture will drop off the end of the pestle in slow, thick drops. With the paper stretched on a board, over a clean blotter, and with the pins on one side loosely inserted, so that they can be removed quickly to stretch the paper, fill your bristle brush with the color and apply to the center of the sheet, in precisely the manner given in the previous paragraph. The coating of the paper and the blending must take place within one minute. The worker is advised to begin on a sheet not larger than 8x10. The paper when coated and blended should then be hung up by the corners to dry, a darkened room or cupboard being used for the purpose.

443. *Printing.*—The only difficulty in printing bichromate paper is in the lack of the appearance of an image. With certain colors—greens and reds, for instance—there is a slight outline shown, but with the heavier tones—blacks and browns—there is no image visible. However, as the latitude of the paper, as stated in a previous paragraph, is very great this difficulty is only apparent, and not real. With the formula first given, that is, the plain bichromate of potassium sensitizer, the sensitiveness of the paper is not so great as when bichromate of ammonium is used. Gum bichromate paper is not as sensitive as carbon tissue, therefore requires longer printing. Generally speaking, the length of exposure of a sheet of gum bichromate paper under an ordinary negative will vary from fifteen minutes to half an hour. In order to print accurately it is advisable to work with an actinometer. A simple device is fully described in paragraph No. 145.

444. With a good standard negative, make some test

exposures with strips of gum-bichromate paper, exposing the slip of paper in the actinometer at the same time you are exposing the test strips, and when the correct tint on the meter has been discovered, that negative can be marked with the time, and from that negative all other negatives can be gauged. As with all daylight printing processes, it is advisable to print a thin negative in diffused light and a strong negative in sunlight.

445. **Developing the Print.**—After printing, the paper can be developed immediately. Development can take place in daylight. For developing two large trays should be employed, considerably larger than the sheet of paper being used. Fill the first tray three-quarters full of cold water, and in this tray immerse your prints with a sliding motion, face up. The surface of the print should not be touched with the fingers, for if the paper is under-exposed the color will come away almost immediately, and especially wherever it is touched.

446. If properly exposed it will take several minutes before the color begins to come away from the paper. First of all, the water will discolor yellow from the bichromate solution, and therefore, it is a good plan, after the print has been in this first water for several minutes, to remove it to the second dish, which is also three-quarters full of clean, cold water. When the print is perfectly limp, and provided it is not under-exposed, it can be raised from the water; then replaced in the water, face down, and left to develop itself. Any air-bells adhering to the paper must be broken up, of course, on either surface of the paper.

447. A correctly exposed sheet of paper will fully develop by itself in from fifteen minutes to three-quarters of an hour, and if the coating has been done carefully and smoothly, and the pigment used is of a very fine nature, the resulting image will be almost as fine in detail as a silver print. When all the detail is clear, the shadows transparent, and the high-lights clean, the print can be removed from the water and laid flat on the back of a dish or stiff card-board until

semi-dry, when it can be hung up to dry by itself. If hung up in its wet state the colors are liable to streak a little. If the worker chooses to alter the nature of the image at all—to work in clouds, change the background, eliminate telegraph poles, or do any other work of that nature on his print—it can be done either while the print is floating face up in the water, or the print itself, when thoroughly wet, can be placed on a board or on the back of a developing tray, and inclined in a tray of water at an angle. Then with a soft camel's hair brush, or with a jet of water from a tube attached to a faucet, all kinds of manipulating work can be effected.

448. The most practical plan is to place the print on a sufficiently large board, which is inclined in a wash-bowl or sink, and apply the water to the print from the end of a rubber hose. By pinching the mouth of the hose the force of the jet of water can be increased or reduced, and by bringing the mouth of the hose near to the print, or removing it, all kinds of spray effects can be produced on the print and clouds can be readily worked in, or other work done, by those who are skilful in drawing, etc.

449. If a print has been over-exposed, this will soon show by the color refusing to come away from the paper in the wash water. In that case the temperature of the water should be raised gradually higher and higher. Or, water can be poured on the print when the latter is on an inclined board, from a height. The force of the water will tear away the color particles, leaving only those parts which have been more thoroughly affected by light. All kinds of implements are used by various workers for working on the print, such as tooth-picks, stiff bristle brushes, etc., depending entirely upon the result desired.

450. Manipulative work on a gum-bichromate print is entirely individual in character. No set rules can be laid down, and the worker as he gains increased experience will evolve methods and ideas for himself. Many workers prefer to over-expose their paper, as this will give them greater

latitude for individual work on the print, and not infrequently an expert gum-bichromate printer will work for hours on his damp print to obtain the results he wishes.

451. **Retouching the Prints.**—It frequently happens that by mischance some of the coloring matter has been removed from the print during development. The color can be readily replaced and the damage made good by removing a little of the color on the edge of the paper; or it is better still to have a little extra sheet of paper coated at the same time as the original print. The color on this little extra piece of paper, when placed in water, will soften and can be removed with the brush to the original print, to make good any damage. This is a better method than to wait until the print is dry and then to mix colors to match.

452. **Clearing the Print.**—Though not entirely necessary, it is often a good plan to place the print in a 5% solution of alum, for the purpose of clearing out any of the chemicals that may be left in it. A short ten-minute bath is all that is necessary. It is best to give the print the alum bath after it has once dried, for then there is no danger of any more color being dissolved away.

453. **Drying.**—The print can be dried by leaving it on a tray or board until it is semi-dry, and then it can be hung up on a cord.

454. **Multi-Coated Prints.**—The best workers in gum-bichromate frequently prefer to give the paper two or three coatings of pigment and gum, developing each coating by itself. A light coating is first applied to the paper in the previously described fashion, and a weak print obtained, with clear high-lights. When dry the paper can be coated a second time, and again printed, some method being used for registering the paper on the negative. The exposed print is developed and dried in the usual manner, and then a third coating is applied, in order to obtain body in the shadows. This need not be fully printed, and a careful worker can retain the color in his shadows and wash away

the color on the high-lights, and half-tones, thus obtaining a print with greater strength all over.

455. **Shrinking the Paper.**—Where more than one coat of pigment is applied to the paper, or with papers that are liable to shrink after having once been wet, it is best, before coating, to shrink the paper thoroughly, which can be effected by leaving the sheet of paper in cold water for at least half an hour, and then after blotting the surface moisture off hang up to dry. Such paper will not be liable to shrink to any perceptible extent during the subsequent manipulations.

456. **Registering the Paper on the Negative.**—There are several methods of registering paper on the negative when the former has to be printed several times.

457. **Method No. 1.**—A printing frame some sizes larger than the negative being printed from must be used. Procure a sheet of stout cardboard the same thickness as the negative. Cut out the center of the cardboard to fit snugly around the negative, and then with a large sheet of glass in the printing frame, as a support, place the cardboard and negative in the frame. Now, adjust your coated paper to the negative, and at the sides draw lines across the paper, extending onto the cardboard. When the paper is being printed a second time these lines on the back of the paper and on the cardboard must correspond.

458. **Method No. 2.**—With the sheet of cardboard as before, insert from the back of the cardboard, about an inch away from each end of the negative, very small drawing pins, so that when the cardboard and negative are in the printing frame the points project upwards slightly. Now, place your paper in the negative and these sharp points will make small holes in the paper. For the second and third printings the paper must be placed on the negative so that the small holes coincide with the pin points. The registering of the prints over the negative will then be sufficiently accurate.

459. **Multi-colored Gum-bichromate Prints.**—A variety

of effects can be obtained by the skilled worker, by coating the print with different colors so as to obtain color effects. This is usually done by first printing in the body color, or that color which is to be most predominant in the print. A second coating can be made with a color to enhance the shadows and half-tones, and a third coating of color can be applied for the sky or any other part that is desired. The method of applying the colors to the paper, sensitizing it, registering the paper on the negative, developing and finishing are the same as previously described, but such work should not be attempted except by those who are skilled in the use of colors. Very good effects can be obtained by making a weak print on platinum paper and then coating this paper with any desired color. The surface of platinum paper is such as to give most beautiful results when coated with gum-bichromate.

CHAPTER XX.

Copying in the Professional Studio.

460. **Introduction.**—The field of copying offers much of real interest alike to professional and amateur photographers, yet it is a branch of the work which is considerably neglected, due, no doubt, to the lack of knowledge of the simplicity of the operations.

461. The copying of old pictures, prints, drawings, paintings, etcetera, requires care and much thought. To the professional a practical knowledge of the methods of copying means a very profitable part of his business, while to the amateur the ability to reproduce old pictures offers an opportunity abounding in much pleasure and usefulness. There are many old pictures which in a very short time will have faded so completely that the outline and all resemblance will be past recognition. There is seldom a home where there are not to be found prints, pictures or records of priceless local or personal interest, that should be copied in order to save their remembrance, at least, from total loss. It is very desirable then, to impress upon you the simplicity of the operations necessary to copy and reproduce any original.

462. The required apparatus may be of the simplest nature, and the methods given herein, after once understood, will enable any one to successfully reproduce any picture.

463. **Apparatus Necessary for Copying.**—For the professional there is no need of any special apparatus. While cameras are made specially for copying and enlarging purposes, their bellows being of practically unlimited extension, yet, unless one desires to make a business of this

feature of photography, it is not necessary to go to the expense of procuring any additional apparatus. All the photographer requires, aside from his regular camera,

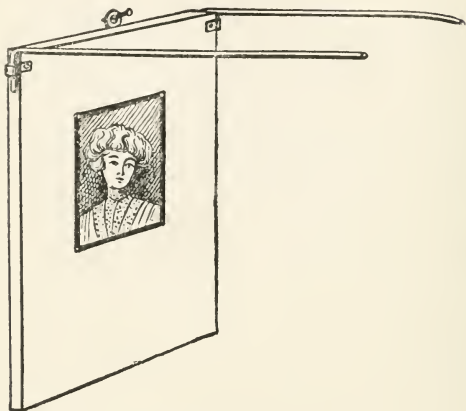


Illustration No. 1
Copying Board
See Paragraphs Nos. 463 and 490

camera stand and lens, is a perfectly flat board made of soft wood, about 10 x 12 inches, with a large screw-eye screwed in the center or one edge of the board, by means of which the board can be hung upon a nail ready to receive the picture to be copied. On the outer edge and on each side of the board attach a very light, but stiff, wire rod, extending over the board about sixteen to eighteen inches. See Illustration No. 1. The use of these rods will be explained later.

464. Drive a good, strong nail in the standard of a movable screen or background, about five and one-half feet from the floor. When you want to copy a picture, attach the picture to the board, using thumb tacks, and hang the board on the nail in the standard. The picture may be

attached bottom side up; this makes it easier to focus, for the image will then be right side upon the ground-glass. Place the standard well under the light, and facing the side light, at a sufficient angle to receive even illumination. If the screen be placed parallel with the side light, there would not only be a stronger light on the side of the picture, but if the picture were an old one, it would show more grain to the paper as well. For this reason, arrange the board containing the picture so it faces the side light at an angle of about 25° , or until there is even illumination over the entire print. Then wheel your camera close to it and you are ready to focus. One thing you must remember: Always have your camera level with the picture to be copied, and if your camera contains the usual swing attachments see that the ground-glass is parallel and square to the print to be copied, and the bed of the camera-stand perfectly level.

465. **Lens to Use.**—Any ordinary rectilinear lens will do, providing it is large enough to cover the print to be copied. A larger lens than sufficient to cover the original to be copied would require a longer bellows. Therefore, a short focus lens is preferable, as it does not require so much bellows length for reproducing a picture the same size as the original or even larger. The corrected lenses are, of course, the very best, yet, with care, good results can be obtained with an ordinary rectilinear lens.

466. **Size of Lens for General Use.**—For all prints up to, and including, cabinet size, there is no better general lens than the old style quarter-size Darlot lens, used generally for carte-de-visite pictures. This style of lens is of large aperture, thus giving good illumination, and there are, perhaps, more of these lenses used by professional photographers for their general copying than any other make. With a lens of this size, or any lens just large enough to cover nicely the print you are copying, you can make any size enlargement up to the largest size plate your camera will take.

467. **Making Picture the Original Size.**—To make

original size copies the distance between the lens and plate must be exactly twice the focal length of the lens. Say, for example, your lens is of five inches focus: Rack out the bellows ten inches; then by wheeling your camera close to the print to be copied you will find that when the front section of the lens is ten inches from the print to be copied you will have a sharp image on the ground-glass the exact size of the original. (See Paragraph No. 523.)

468. Stopping Down Lens.—When copying prints original size, do not diaphragm down any more than is necessary to secure a good clear definition. Too small a stop will make your picture wiry and harsh and will also copy more of the grain of the paper, which is objectionable in copies. When making copies larger than the original size, then small stops will be required in order to secure sufficient sharpness. First, it is always best to focus as sharp as you can without a stop, and then use as large a stop as possible and yet retain good, sharp definition.

469. Lighting the Original for Copying.—The most satisfactory light to employ is daylight, as by means of a large flood of light you can illuminate more evenly the original to be copied, which is essential for the best results. Even with good daylight, in order to avoid grain in the negative you must exercise care when lighting your original, for if the light comes too much from one side or top it will accentuate the grain in the copy by making shadows from the rough surfaces which exist in the paper of the copy. So you must light as broadly and flatly as possible, and if the original is very rough and sort of pebbled, use a white reflecting screen on the side opposite the source of light. In this way, the shadows of the surface are filled with reflected light and they will not show badly, if at all. Under-exposure also helps to show the grain in the texture, for the shadows, then, do not receive time enough and the high-lights of the grain develop up strongly, thus accentuating the shadows. Moral: Always give full exposure.

470. Enlarging.—When making quite large copies from small originals, sometimes the lens employed is of too



Illustration No. 3—See Paragraph No. 489
Colored Daguerreotype Copied with
Ordinary Plate



Illustration No. 4—See Paragraph No. 489
Colored Daguerreotype Copied
with Orthochromatic Plate

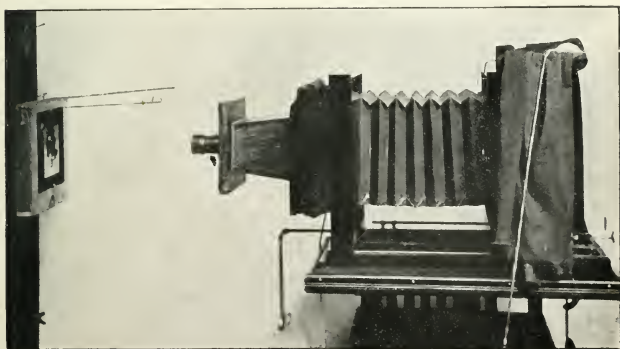


Illustration No. 2—See Paragraph No. 470
Copying Apparatus (Showing Lens Extension Cone)

long a focus and the bellows in the camera will not admit of enlarging to the largest size plate your camera will receive. You can then lengthen the camera by adding a cone extension to it. The cone can be made of light wood, box-shaped, open at both ends, and made of a size to fit one end in the front of the camera in place of the front-board, the lens being attached to the other end. (See Illustration No. 2.) This box or cone should be made about 14 inches in length, and must be painted a dead black color on the inside, to prevent any white reflection, which would fog the plate.

471. **Stops to Use.**—There is no set rule to follow regarding the necessary stop to use. One must be guided entirely by the appearance of the image on the ground-glass. Always focus with an open lens and then gradually stop down until the image appears as sharp as the original to be copied; then use the next smaller stop and you will have plenty of sharpness, and by giving full time you will preserve all the quality there is in the original. Remember, when enlarging, the more you enlarge the smaller the stop you must use in order to retain sharpness and roundness, and, of course, you must time accordingly.

472. **Fogging the Plate When Copying.**—Pictures which are mounted on white card-mounts, with a wide margin surrounding the print, will fog the plate, especially if a long exposure is required. The white card margin will reflect the light into the lens, and this reflected light acts more sensitively on the plate than the light reflected from the original picture to be copied. Consequently, a long exposed plate receives more reflected white light from the white margin than it does from the picture. To avoid this reflection make a mask of some dull black paper; cut out an opening the size of the picture to be copied and cover the cardboard entirely with this black mask. You thereby avoid any further reflection.

473. **Overcoming Light Reflection in the Lens.**—It is always advisable to use a camera much larger than the plate you intend using for copying, because the farther

the plate is away from the bellows the less danger there is of the plate becoming fogged near the edges by the reflection from the bellows. The reason for this is, that all of the light passing through the lens does not go to the formation of the image. A great deal of it falls upon the bellows and is reflected from there onto the plate. This defect is most noticeable when prolonged exposures are given, and on the portion of the plate where the deepest shadows appear in the picture you are copying. To overcome this trouble you should use a cardboard cone or hood fitted over the lens. The size of this cone should be as small as possible, but sufficient to prevent the light reflecting into the lens, and yet, at the same time, it must be large enough so as not to interfere with the angle of the lens. This hood or cone is also very useful when small pictures, such as miniatures or dark glazed objects which reflect more light, are being copied, as, in addition to other advantages, it prevents the lens mount being reflected from the glazed surface. The interior of the hood over the lens, of course, must be painted with a dead black surface.

474. **Plates to Use.**—Ordinary slow plates are best for general copies. Very good originals are improved sometimes by using an Isochromatic plate, but old pictures that are yellow and stained should never be copied with any color sensitive plate (Isochromatic or Orthochromatic), as these plates tend to increase the blemishes much more strongly, being sensitive to the different colors that are found in old pictures. By the use of slow Orthochromatic plates you can sometimes make better copies from a fine print, one full of half-tones and color value, but never use them on stained, old, or faded yellow prints, for, as said before, these plates are sensitive to the different color values, and the defects will appear more prominent in a copy than they will in the original. It is advisable to use a slow plate, for the reason that slow plates have more latitude, both in the exposure and development. An ordinary slow plate, when over-exposed, can be handled much more easily in correcting the exposure during development. There is also less

danger of over-exposing a slow plate. If under-exposed there is also more latitude in the slow plate while developing than there is in the fast plate. The slower the plate, the finer the grain of the emulsion.

475. **The Use of Orthochromatic Plates.**—In copying oil paintings or originals that are colored, you will find it necessary to use a color sensitive plate for good results. We will briefly describe the use to which Isochromatic and Orthochromatic plates should be applied.

476. The Orthochromatic plate is more sensitive to green and red; therefore, before deciding upon what plate to use when copying colored originals, note the color values you have to retain, and use a plate that will best preserve those colors. If you desire to copy a picture where green and red predominate, use the Orthochromatic plate. If, however, the predominating colors are green and yellow, use the Isochromatic plate. For the very finest results, when copying colored pictures, especially oil paintings, a color screen should be used in connection with a color sensitive plate. These screens are known as ray filters, and fit over the front of the regular lens. A very simple screen or filter, which we can highly recommend, is the Ideal Ray Filter, which can be used with any make of dry plate on the market. It gives true color value to all objects in a picture, whether landscapes, interiors, flowers, portraits, or to any picture with colors. It is well to bear in mind, when using this screen, that the exposure must be about three times that of the normal.

477. Another very fine filter is the Isochrom Absolute Ray Filter. This filter renders all colors in exact visual luminosity. The adjustment of this ray filter is quite perfect. It is put up in nickel plated cells to fit over the lens hood, and is supplied in a neat circular plush lined case, which can be used as a lens cap when required.

478. When purchasing one of these screens it is advisable to select the large size, so that you can adjust it to any size lens you may use for copying. The advantage of a filter or screen is as follows: While color-sensitive

plates are effected by only a few distinct colors, yet by means of a suitable screen the plate is made sensitive to additional colors. There is no plate made which is as sensitive to green and red as to blue; so it is necessary that a screen be used—one that will subdue a certain portion of the blue. A yellow screen will do this, and very often, when the blue is quite brilliant, a deep orange or yellow screen is required to improve the results and equalize the colors, thus producing good values. These filter screens are sold or recommended by the plate makers, and should be procured with the plates when ordered.

479. **Exposure.**—The necessary exposure required for copying pictures generally is difficult to state, for there are three principal factors that must be considered in making the exposure: *First*, the lens employed; *second*, the stop used; *third*, the color of the picture to be reproduced. With a lens of good aperture, requiring only slight stopping down, you can make a quicker exposure than with a lens of small aperture.

480. Another point to be considered is, that when stopping a lens down—if for instance we are making a picture the exact size of the original, and we use the lens stopped to f. 8 for ordinary work—using this same stop for copying work you actually stop the lens to f. 16, as the plate is then twice the distance from the lens, and will, therefore, require four times as long an exposure. Ordinary copies from good originals, copied to the same size, will usually require from ten to thirty seconds, and if the original is to be enlarged, calculate on triple the exposure each time you double the size. For instance, if for a copy to the original size you require 20 seconds exposure, to double the size you would require 60 seconds, to triple the size you would require 180 seconds, etc.

481. **Color of Original.**—The color of the original makes a big difference in the exposure necessary. For instance, if the original is a good fresh print, with a medium-colored background, you will give less exposure than with a fresh print with a black background. Should the original

be an old yellow print, discolored and stained with age, the color of the print must be taken into consideration. The best way to judge the necessary exposure is to note the appearance of the image on the ground-glass after stopping down sufficiently to give sharp definition, and then make the exposure accordingly. If any error is made in exposure let it be on the side of over-exposure, as the plate is very easily controlled in the developer. One can, after a little experience, train oneself to judge very accurately. In fact it is the only practical way of judging the proper exposure.

482. **Latitude in Exposure.**—There is a wonderful amount of latitude in exposure for copies, as usually slow plates are used, and one should always expose for the densest portions and time them fully. It is in fact advisable to aim at over-exposure and then use a few drops of Bromide in the developer. As stated above, the exact exposure can only be ascertained by experience. After a few experiments with different kinds of copies one will soon be able to judge with sufficient accuracy to make every exposure correct.

483. For your first experiments a good way to ascertain the correct exposure is by a test plate. Select a fairly good original to copy from, and in order to arrive at the proper exposure for this kind of copies, note the appearance of the image on the ground-glass. If it is fairly clear and you judge the plate will require eight seconds exposure, place the plate-holder in the camera and cap the lens or close the shutter. Draw the slide about two inches and expose the first two inches say five seconds; then draw the slide one inch more and give another five seconds exposure, after which draw the slide another inch and give five seconds more exposure; then draw the slide entirely and give another five seconds exposure. You will then have four different exposures on this plate. The last portion will have had five seconds, the next portion ten seconds, a third 15 seconds, and the first exposure made will have received 20 seconds altogether.

484. Now develop the plate and you will probably find that you will have a correct exposure on some portion of the plate. You can then take another plate and give it the correct exposure. You should take your test plate and make a good strong proof from it, and on the back of the proof note the time of the different exposures, and any other data connected with the producing of the results. File this proof in your proof file for future reference. Experience, of course, will enable you to judge every exposure accurately by the appearance of the image on the ground-glass, and you will not need to experiment in this way.

485. **Development.**—All copy-negatives receiving a full exposure must be treated accordingly, and be developed slowly and considerably farther than for ordinary work. In order to avoid fog and retain the snap throughout the development we advise adding three or four drops of a 10% solution of Bromide to your normal developer. Mix well and proceed to develop in the usual manner. Remember that plates from copies should be carried at least one shade farther in developing than regular work. Work very carefully, and once you have produced a good copy-negative you will have a key to guide you in your future work.

486. **Developing Special Plates.**—Great care must be exercised when developing color-sensitive plates. Either cover your developing tray or develop away from the ruby-light, and when judging the development do so as quickly as possible, as the plate is sensitive even to ruby-light and will fog in a few seconds. Remember these special plates are extremely sensitive to all colors; so keep them in the dark during development. These special plates usually give the best results when developed according to the formula accompanying them, and should be handled in that way. The plates, after developing, should be fixed, washed and dried in the usual manner.

487. **Copying Oil Paintings or Water Colors; or any Colored Objects, Such as Colored Lithographs, Etc.**—For the copying of these, or any good, clear prints, with much color, use a slow Isochromatic plate, and time as long again

as with ordinary plates. For old faded pictures, tintypes, or soiled pictures of any kind, use an ordinary slow plate, time fully, and develop in normal developer, with a few drops of Bromide added.

488. Be careful to develop color-sensitive plates in either a covered dish, or develop away from the ruby-light, as they are apt to fog and mislead you, being sensitive to the ruby-light. When copying paintings, unless they are very bright and of a high color, give fully ten times the exposure you would give uncolored prints. Sometimes it requires ten minutes in a strong light to secure the best results.

489. When copying from glossy prints you will find that they will not require as much time as dull surface ones. When *reducing* from a large picture you will find it will not require so long an exposure, for the reason that the lens is nearer to the plate or ground-glass and the illumination is greater. Exercise great care, when copying large pictures to a small size, that your picture or drawing is placed absolutely perpendicular and parallel with the camera. Oil paintings or colored pictures of any sort copy best on good bright days. When copying drawings you require a smaller stop than for other pictures, as each line must be perfectly sharp. Illustrations Nos. 3 and 4 show copies from a colored Daguerreotype. One exposure was made with an ordinary plate, while the other was made with an Orthochromatic. (See Page 157.)

CHAPTER XXI.

Important Notes on Copying.

490. **Copying Old Pictures.**—Should you have engravings or rough prints, or old albumen prints badly scratched and cracked, you can greatly improve them by coating the print with glycerine and then squeegeeing on to a good, clean glass. The glass containing the print can be fastened to the copying board and, in order to avoid reflection from the glass into the lens, attach two large sheets of tissue paper together and lay them across the two wire rods extending from the copying board. The tissue paper will screen the light and give even illumination over the picture, besides overcoming any reflection of the lens. In fact, it is a good idea when copying anything with a glossy surface to shield the original with the tissue paper. Especially should this be done if the reflection bothers you at all. See Illustration No. 1, page 154.

491. **Placing Originals to be Copied in a Printing-Frame.**—Where prints are bent and warped, a good way would be to place a sheet of plain glass in a printing-frame larger than the print to be copied, then lay the print next to the glass and clamp the back of the frame in position. Attach the printing-frame to the copying board and copy the print through the glass. It is needless to state that this glass must be perfectly clean and clear from any spots or marks. The glass over the print often assists in giving detail, as well, to old prints. For pictures that are yellow from age, perhaps soiled from handling, the surface may be cleaned by rubbing over with some stale bread. The bread usually will take up the smoke and soil from the print, and it will make a much better copy. When copying old pic-

tures that have been stained, you should stop down only enough to make them clear and sharp. Should you stop down to the extreme you would accentuate these spots and stains, and they would appear stronger in the reproduction. Understand, your focus must be sharp, but not wiry, for this class of work, and do not be afraid to give long exposure. Any copy must be fully timed and never underexposed, but particularly those you stop down must be timed more fully; also remember that it is best to use slow plates for all copies.

492. Copying Originals That Are Flat in the Half-Tones.—Such originals may be improved in the copying by giving a quite accurate exposure and using a restrained developer. In place of four or five drops of Bromide use about ten. Pyro developer is the best for such reproductions.

493. Copying Contrasty Pictures.—Contrasty pictures can be improved in the copying, by giving full time and developing, with normal developer, to a good strength.

494. Copying Line Drawings.—When copying line drawings care must be exercised lest you produce distortion. See that the camera is perfectly level, and the ground-glass perfectly perpendicular and on exact alignment with the drawing. Usually these drawings are quite large, and therefore a short focus lens should be used. To insure accuracy, the drawing should be measured on the ground-glass, and should the lines converge in any direction, by means of the swing-back you can adjust them so they will be reproduced true to the drawing. A very small stop must be used for this work, as this will accentuate the contrast, as well as give good sharpness, which is essential in this instance; and negatives of drawings must be developed in contrasty developer.

495. Distorted Pictures.—Sometimes distorted pictures may be improved in the copying. By means of the tilting of the swing-back the lines may be made parallel, and then by stopping down you will obtain sharp definition and overcome the distortion.

496. Copying Faded Pictures.—Sometimes pictures

that are not too badly faded, may be improved quite considerably in the copying. For instance, if the original is a portrait and the drapery is dark and partly faded away, a little black crayon applied to the portions of the drapery that are faded will help build up those portions. If the face of the portrait is considerably faded, a very light application of a little yellow ochre powder to the portion of the face which is faded will build up the face somewhat and assist in supplying some of the portions that are faded away. Where the fading is principally in the drapery, or where you do not wish to deface the original, a great deal of work may be done on the negative with an etching knife, for by scraping the film you can darken the shadows, and if this be done carefully you can outline any portions that you desire and gradually blend in with the etching knife. Where platinum paper is used, some extra work may be done on the print after it is printed.

497. **Copying Figures From Groups.**—The photographer is very frequently called upon to copy one member from a group picture. In vignetting one portrait from a group we have many obstacles to contend with. Frequently the figure is in a reclining position, which looks perfectly natural while arranged in the group, but the removal of the support from this portrait gives it a different appearance. Or again, we desire to vignette a figure from a group, and find that the arms, hands, or perhaps shoulders, of another member are leaning on the figure to be copied. It is simple enough to vignette the single figure from the group, but the difficulty arises in making the reproduction so that anyone—not knowing how the picture was produced—would not recognize the altering. For work of this kind, while a great deal of doctoring and blending might be done to the original picture, yet usually customers do not like to have their original picture defaced in any way, and under such circumstances all the work must be done on the negative, and it is equally as convenient to apply the work in that way.

498. First of all, make a negative of the particular

subject from the group in the regular way; copy it to the size you desire, admitting all the surroundings, as they will do no harm. After making the negative, paint out the background with opaque, formula for which is given in *Printing Notes*, Vol. IV. Paint close around the head and shoulders. If the subject is reclining it should have been copied so as to appear more erect when placed by itself. This naturally will make the shoulders uneven, and when blocking out the background due allowance must be made for the raising or lowering of the shoulders, so that both will be on a line. After blocking—painting out the background—and making allowance for the shoulders, should there be any other objectionable features—such as the hands or shoulders of any other members in the view—these may be worked out by means of the etching knife and retouching pencil. If they are white spots they can be etched away with the etching knife; if they are black spots, they can be built up with Prussian blue and the retouching pencil. (For instruction in Retouching and Etching, see Vol. X.)

499. After the work is done upon the negative the objectionable portions close to the subject must be painted out with opaque, after which the negative should be placed in a printing-frame, and a vignette prepared which will blend very closely to the head and shoulders. The vignette should be covered with at least two pieces of fine tissue paper and printed in subdued light, and the print should be made on Platinum paper. After the print is made and developed you may have faint sharp lines, owing to the close blocking or painting out. The print may also show slight effects of the etching knife. All this can be altered in the print, by applying, very delicately, a little crayon sauce to the outline, and rubbing it in with the point of the finger, gradually blending it. In fact, the crayon sauce should be applied so as to blend away from the portrait, at least an inch all the way around. After you have applied all the crayon sauce necessary to give a soft blend and vignette, and have built up the drapery where required in the same way, then cut in a few lights into the background with a



no. 1.



no. 2.



no. 3.



no. 4.

Illustration No. 5
Copying from Groups—Reproduction from a Tintype
See Paragraph No. 500

rubber craser, thus supplying a little sketchy effect to the background and relieving the monotony of the vignette. For further instruction as to the manipulating of the crayon sauce and blocking the negative, etc., see Volume IV, Making Gravure Portraits.

500. In Illustration No. 5 we show the four stages of procedure in copying from groups. In Fig. No. 1, we have a reproduction from a tintype which is pretty badly defaced. In Fig. No. 2, we have etched into the face of child, thus carrying the work to the second stage. In Fig. No. 3, we have the print blocked out with all the objectionable portions removed. In Fig. No. 4, we have the finished print.

CHAPTER XXII.

Copying With Hand or View Camera.

501. **Introduction.**—Any picture, no matter of what nature, can be copied, only you must understand, first of all, your instrument, and then the photographic quality of the picture you desire to copy. Different kinds of pictures require different treatment. The successful reproduction of a print depends largely upon the operator. In this lesson we will cover only ordinary work that can be performed with the regulation hand or view camera.

Brief General Instruction.

502. **Apparatus.**—The ordinary extension hand or view camera used for outdoor work will answer for all ordinary copying. Fixed-focus cameras cannot be used successfully for this work. Cameras fitted with a long bellows are preferable.

503. **Lenses.**—Single lenses will not do for copying, as they will give distortion and curved lines. A single lens has not a flat field, and as all objects to be copied are usually on a flat surface, you require a lens that will give you a fairly flat field, with a sharply defined image, in which the straight lines of the original are rendered rectilinear and free from distortion. Any ordinary rectilinear lens will do. The shorter the focus, however, the better. With the long focus lens you will require longer bellows, in order to reproduce to the same size. Any lens, which is fitted to a camera with a bellows capacity a little more than twice the focal length of the lens, will answer the purpose.

504. **Copying the Original Size.**—In order to copy a picture to the size of the original, the distance between the lens and plate must be exactly twice the focal length of the lens. Some lenses of long focus are fitted to cameras

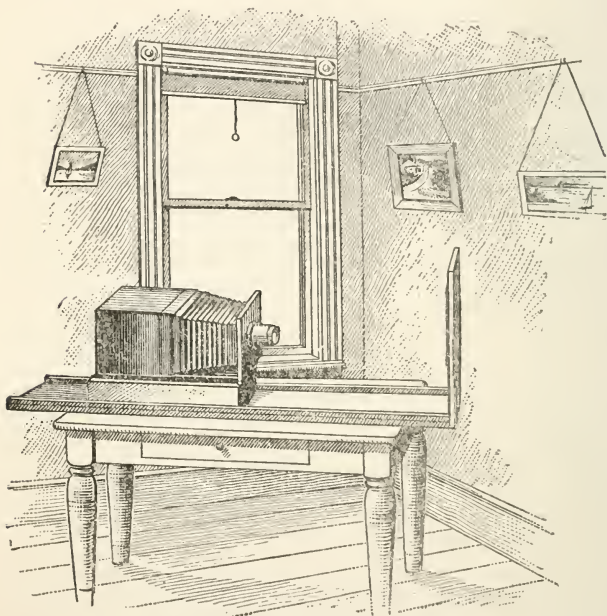


Illustration No. 6
Copying Apparatus
See Paragraph No. 505

the bellows of which are not sufficient to allow of the lenses being used for copying; therefore a lens of shorter focal length would be an advantage. Most modern cameras are supplied with extra long bellows that allow for the extra long focus lens when used in telephoto work, copying, etc.

However, the lack of focal length can be overcome and any short bellows camera can be used by means of a cone attached either to the front or the rear of the camera, or supplementary lenses may be used which fit over the flange of the regular lens, thus converting it into a short focus lens.

505. **Copying Board.**—While a regular copying board and a guide upon which to adjust the camera are unnecessary, yet you must exercise care that the camera is placed square to the original. This is essential, otherwise distortion will result. In Illustration No. 6, we have a very simply constructed copying board, made from an ordinary pine-board, 10 inches wide and 4 feet long, with an upright piece, 10 x 14 inches, attached to one end. Upon this end block you arrange the picture to be copied and for convenient focusing the original may be hung upside down. Your camera and picture are attached to the same board and, therefore, are at all times parallel with each other, and when moving the board containing the picture to be copied to and from the light, in order to secure an even illumination, your camera is moved at the same time, so you are always ready for operation.

506. It would be better to have the camera attached to a box or some support which will elevate it above the board, otherwise you may be troubled with reflections from the board into the lens. A block or box about five inches high would overcome all reflection. To each edge of the board should be attached a narrow strip which will serve as a guide for sliding the camera forward or backward while focusing.

507. **Proper Copying Light.**—Any ordinary window will do, the larger and higher the better. A window facing the north is preferable, as you will then have an even illumination at all hours of the day.

508. **Lighting the Original to be Copied.**—Do not arrange the camera and the picture to be copied parallel with the window, but at an angle so that the picture will receive even illumination. This is essential. See Illustration No. 6.

509. **Copying the Picture.**—As before stated, in order to copy a picture the size of the original, you will need to extend your bellows to twice the focal length of your lens. For instance, if your lens has a 5-inch focus, then extend the bellows to 10 inches. Covering the head and camera with the focusing cloth, slide the camera along from the end of the copying board towards the original until the latter focuses sharp on the ground-glass. When you have the picture focused sharply on the ground-glass you are ready for the exposure.

510. **Plates to Use.**—Ordinary slow plates should be used for all general copying.

511. **Stops to Use.**—When copying good, clear pictures use as large a stop as possible. A good plan is to focus without a stop and gradually stop down the lens until you secure a clear, sharp focus. Then use a one size smaller stop and you will be sure of having a good sharp picture.

512. **Copying Old Pictures.**—For pictures that are yellow from age, perhaps soiled, etc., you should stop down only enough to make them clear and sharp on the ground-glass, for to sharpen them by stopping to extremes would accentuate the spots and stains. Don't misunderstand—your focus must be sharp, but not wiry, for this class of work. For ordinary work stopping to U. S. 8 or 16 will be sufficient. For some copies, however, especially those you make larger than the original, you must stop down more, using from U. S. 32 to 48 stops, in order to make them clear and sharp, and then time in proportion, calculating your exposure by the appearance of the image on the ground-glass.

513. **Exposing.**—Having carefully adjusted your plate-holder to your camera and drawn your slide, cover the camera with your focusing cloth, close your shutter and turn the dial to time exposure. Now, the question of time and size of stop to use are very essential. For instance, if the original is a good clear picture, we would advise using a stop U. S. 8 or 16, and, if a bright day, three seconds exposure is sufficient. The exact exposure, however, can

only be attained by experience. Three seconds may not be enough; it may require double that exposure. All will depend upon the strength of the light you are working under and the stop used.

514. For your first experiments a good plan would be to make several exposures on a plate, as follows. Draw the slide part way, exposing part of the plate, and give three seconds exposure; draw it a little further and give another three seconds exposure; finally, draw the slide entirely and expose again. You will now have three different exposures on this plate, the first portion having received 9 seconds, the second 6 seconds, and the third 3 seconds. Proceed to develop the plate. Some one of these exposures should be correct, and will serve as a guide for future exposures. After a few experiments you will be able to judge quite accurately the correct exposure for all classes of copies.

515. **Developing.**—Normal developer should be used, and all copies having a full exposure must be treated as such in the development. Copies must be developed farther than other exposures, and, to avoid fog and retain snap throughout the development, add three to five drops of a 10% Bromide solution to your normal developer. Mix well and proceed to develop. Copies should be carried one shade farther in the developer than regular exposures.

516. **Printing.**—The quality of the original from which the copy is to be made should determine the printing paper to use. If the original was a good clear print, any printing paper may be used. If the original was flat, then developing paper should be employed, as more contrast can be obtained. Platinum paper usually gives the most satisfaction, as the imperfections, grain of the paper, etc., of the original will show less on this paper.

CHAPTER XXIII.

Copying With Hand or View Camera.

Detailed Instruction.

517. **Apparatus.**—Any camera that is suitable for ordinary photographic work, no matter what size, can be used to copy a photograph or any picture. For the amateur the only essential extra piece of apparatus required is a copying-board, or some kind of an arrangement for carrying the camera and the original to be copied, so that the plate and subject copied may be perfectly parallel.

518. Special cameras are made for copying and enlarging purposes, their bellows being of almost unlimited extension, but unless one desires to make a practice of this business in photography it is not necessary, as previously stated, to go to the expense of procuring any additional apparatus.

519. **Lens.**—As objects which are to be copied are usually perfectly flat and contain lines, the lens employed should be one which will give a perfectly sharp, well-defined image on a flat plate, in which the straight lines of the original are rectilinear. It is, therefore, essential to have a lens which will give a flat field without distortion, and if this can be secured it is not necessary to take into consideration the rapidity of the lens. Everything else being equal, the shorter the focal length of the lens used for copying the better, because the bellows extension required will be much less than when using a long focus lens. To obtain a copy of the same size as the original, the distance between the lens and plate must be exactly

twice the focal length of the lens, and it is very seldom the case that the average camera bellows will rack out far enough to allow the lens fixed to it to be used for this purpose. Hence, the advantage of a lens of shorter focal length. It is not a hard matter, however, to get over this difficulty, as will be seen from the following instruction.

520. As the single or view lens does not give a perfectly flat field, and bows out straight lines toward the edges of the plate, this particular kind of a lens cannot be employed when it is being used to cover a plate which is rather large as compared with the focal length of the lens. When compound or double lenses such as the rectilinear lens, are employed, nothing shorter than one of 6-inch focal length should be used on a $3\frac{1}{4} \times 4\frac{1}{4}$ plate, or a 7-inch lens for a 4 x 5 plate, and the shortest advisable focal length to use with a 5 x 7 plate is 9 inches. If the modern anastigmat lens is employed, or one similarly corrected for the various effects of aberration, etc., it is possible to use an instrument of shorter focal length, as these lenses, due to their peculiar correction, are able to render a perfectly flat field on all portions of the circle of illumination. When using single and rectilinear lenses only the central part of the lens field should be employed, as the defects here are very small.

521. A good general rule, however, in selecting a lens for copying, is to employ one which is of practically the same focal length as the lens which was first used to make the picture being copied. It is possible then not only to make a reproduction exactly the same size as the original, but also to enlarge it to a considerable extent, if desired.

522. Since copying is simply photographing with a print as the subject instead of a person, or object, the operation is not as difficult as it might at first appear to be. The securing of the desired size of the picture is, however, the most puzzling thing, with most beginners at least. Taking it for granted that you have a camera with a focusing-screen so that you can see on the ground-glass the image of the picture which you wish to copy, arrange the camera on the far end of the copying board. Upon looking at the



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image on the ground-glass after it is sharply focused, you will now observe that it presents a very tiny speck on the ground-glass due to the fact that the camera is at considerable distance from the subject.

523. An important principle of copying is here illustrated in that the nearer the camera is to the object the larger will be the image, and as in most copying it is desired to secure an image nearly, if not quite, as large as the original, the camera must be placed very near to the object. At the same time, the nearer it is to the object the farther must be the ground-glass from the lens, until if we are copying the same size, the lens is exactly twice its focal length from the subject, and the ground-glass is the same distance from the lens. If using a 4 x 5 camera equipped with a lens of 5-inch focus, the total distance from the ground-glass to the print being copied is 20 inches, and the lens will be midway between the two.

524. If it is desired to copy larger than the original, the camera must be still nearer and its bellows extension still greater. Here is where the difficulty usually comes for the amateur, as the average cameras, however suitable for most all other purposes, will not permit of bellows extension sufficient to do copying on any reasonable scale. To ascertain the limits in this direction, extend the camera bellows as far as it will go. Then place a foot-rule on the copying-board and push the camera towards it, keeping the camera square with the rule until the image of the rule is sharply focused. Focusing must be entirely done by moving the camera, keeping the bellows fully extended all the time.

525. If you are using a 4 x 5 camera, and the long way of the 4 x 5 plate—when the rule is focused—just shows a picture of 10 inches of the rule, it is clear that the greatest possibilities of this camera in the way of copying will be to give a picture of an object 10 inches long on a plate 5 inches long, *i. e.*, half the size of the original, and to get that, the bellows must be extended to the utmost. If you possess a shorter focus lens, you will find that with the same exten-

sion of camera it is possible to get a sharp picture with the camera placed nearer to the object, and the image will be larger accordingly; therefore, one of the uses of a short focus lens is to give a large scale picture with a comparatively short extension of camera bellows.

526. But the average amateur does not care to buy a lens specially for occasional copying; moreover, it is not necessary. An ordinary magnifying-glass (the weaker the better) may be placed in front of the lens. A reading glass will do, but is rather more powerful for the purpose than is best. In either case, the glass should be a trifle larger than the lens employed so that the rim of the frame containing the magnifying-glass will slip over the flange of your regular lens. Should the magnifying-glass be too large, it may be centered before your regular lens by means of wooden wedges between the rim of the magnifying-glass and the lens-flange; or another simple way would be to attach around the lens barrel a light spring wire with three little prongs long enough to receive the rim of the magnifying-glass.

527. The effect of this extra glass is to make the lens apparently a shorter focus one, and to allow of the camera being placed nearer to the object being copied, and so secure a larger image on the ground-glass. As the new lens is not so carefully centered in its mounting as a photographic lens should be, and as it is not "achromatized" or "corrected" for photography, it will be found that the image perhaps will not be so sharp as can be obtained with the original lens by itself. But this does not matter very much, because in copying, the object being stationary, it will not move during exposure, so that by employing a small stop it is possible to counteract this want of sharpness and get as good definition when the supplementary magnifying-glass is used as it is possible to secure without it.

528. However, when one has not a reading-glass at hand, we would advise the purchase of one of the Ideal Enlarging Lenses manufactured by the Burke & James Company of Chicago. These are supplementary lenses

that fit over the regular lens like a cap and are made in different sizes to fit any size lens you may have. Therefore, for the benefit of those who have a camera with a short bellows, we would advise that they provide themselves with a copying attachment. They are made in sizes from $1\frac{5}{8}$ to 3 inches in diameter and listed at from \$1.50 to fit any size lens up to and including $1\frac{1}{2}$ inch diameter, to \$3.50 for the largest size. The \$1.50 size is suitable for any ordinary rectilinear lens 4 x 5 or 5 x 7. These auxiliary copying lenses, as you will note, are inexpensive and are made so that they will slip over the hood of the lens.

529. The Ideal Enlarging and Copying Lens is made to be used in combination with any photographic lens, increasing its power for copying to at least twice its original capacity. It will enable those possessing cameras, that are not long focus instruments, to photograph small articles to their full size or even larger, if desired. It will be found invaluable for copying pictures, making lantern slides by reduction with a short bellows hand camera and photographing small objects.

530. Some idea of the value of this lens can be learned when two photographs taken with and without the lens are compared as to size. A 4 x 5 photograph when copied with an ordinary camera will produce a picture about the size of a postage stamp, whereas when the Ideal Enlarging and Copying Lens is attached to the lens the photograph can be copied full size, or can be enlarged beyond its natural size.

531. This lens is composed of two elementary lenses of different density and refracting power, which are cemented together and form one corrected lens. The glass is of the finest optical quality of unusual hardness and brilliancy, and the curves are especially computed to give the best results. Each lens is accurately centered, and has ground and polished edges, which are points of great importance.

532. The lens is mounted in a brass cell, polished and

nickel-plated, with adjustable springs, so that it fits over the hood of the regular lens like a cap.

533. **Extension Device.**—In order to supply sufficient distance between the ground-glass and the lens, the lack of bellows capacity can be overcome by having a box made of very light material, open at each end. This box can be made either to fit into the place of the front-board containing the lens, or it may be fitted to the rear of the camera in the place of the ground-glass. The latter is preferable where the hand camera is employed, for the reason that the majority of hand cameras are supplied with a very small front-board, permitting of a very short cone only, while, when the cone is fitted to the rear of the camera there will be no obstruction between the lens and the ground-glass, and there is more latitude for adjustment of the size of the copy.

534. When the cone is fitted to the front of the camera it must be arranged so that one end will slip into the space occupied by the front-board and lens, and the other end must be arranged to receive the front-board containing the lens; but, as said before, the attaching of a cone to the rear of the camera is preferable, as a larger cone can be used.

535. When a view camera is employed, the cone should be attached to the front of the camera, as the space for the front-board is much larger, permitting of the use of a larger cone, and the attachment is the same as with the professional portrait camera. (See Illustration No. 2, page 157.) The cone should be made of light wood, fitted closely to the camera, and, in the case of a hand camera, attached to the rear of the camera in the place where the ground-glass frame is fixed. The ground-glass frame or reversible back (provided the camera is fitted with one) must be moved to the other end of the cone, an arrangement being made to attach this part to the cone exactly the same as it was attached to the camera.

536. The size of the cone depends on the length of focus necessary. It is best to have it a trifle larger than the length of focus required, thus allowing for making

copies larger than the original. For a 5-inch focus lens the total distance should be about 12 inches, measured from the rear of the lens to the ground-glass. Circumstances and the construction of the particular camera which you are using must decide which is the simpler course. In any case, the most important consideration is to allow a largely increased distance between the lens and the focusing-screen. In some manner strive to arrange your camera so that the lens may be placed twice as far from the ground-glass as it is when ordinary landscape work is being done. If you can do this you will be able to copy the same size as the original. When this has been accomplished, copying becomes a very simple process. It is a matter of arranging the original in a good light (not direct sunlight), the camera in perfect line with the original and giving the correct exposure.

537. **Proper Copying Light.**—If the atmosphere is perfectly quiet and there is no chance of the camera or the print being blown about, copying may be done out-of-doors. If the work is to be accomplished indoors, the original should face, or almost face, the window—not be along side of it—and the camera, of course, will be between the subject and the window, but at an angle. By this arrangement the visible grain on the paper, which is seen at its worst when the print to be copied is lit from one side, is done away with.

538. This texture or grain is caused by little particles of the paper standing out above the surface of the print. When the light comes from one side these little particles, standing out, will cast a shadow which will intensify the grain or texture and cause it to appear much stronger. Therefore, in order to avoid the grain in your negative, you must exercise care when lighting the original picture, lighting as broad and flat as possible. If the picture to be copied is very rough, or has a pebbled appearance, use a white reflecting-screen on the side opposite from which the strongest light comes. In this way the shadows of the surface are filled with strong light and they will not show

so badly, if at all. Bear in mind too, that under-exposure also helps to show grain, for if the shadows do not receive enough exposure and the high-light and grain develop up strongly the shadows will be accentuated. The use of an extremely small stop is also apt to cause the grain to show strongly.

539. Artificial Light.—While the best results are obtained by daylight yet it is possible to copy at night by lamp, electric, or gaslight. The arrangements, however, are practically the same, except that with artificial light two lamps should be employed, one at each side. This will give a more even illumination. Each light should be partly surrounded by a sheet of white cardboard bent in semi-circular shape, and held in that position with a piece of thread around the top and bottom. This reflects light onto the object and prevents any light shining into the lens. If kerosene lamps are employed they may be placed on the table, nearly between the camera and the picture to be copied—the nearer the object the better, so long as they do not come within the range of the lens.

540. Exposure.—With artificial light the exposure may be anything from two minutes to an hour, depending entirely upon the light employed, while in daylight, out-of-doors, even with a small “stop” it may not be more than a few seconds, and indoors from eight to sixty seconds and perhaps more, depending upon the illumination as seen on the ground-glass.

541. The two greatest difficulties in this work occur in correctly judging the exposure and properly developing the negative. You must remember that however clear and bright may be the subject that you are copying, its contrasts are very much less than those of nature; therefore, if you do not desire a flat result, it is very essential to give a full exposure and follow this up with a full development.

542. Plate to Use.—The plate to use is not so important—any good plate will do for copying (a slow emulsion preferred)—and unless you have a great deal of this work to do it is better to use ordinary plates and to learn to use

them well than to undertake to try specially prepared plates, for the average worker will produce better results with the regular plate and the majority of professional photographers use nothing else. One point is important: You must never under-expose; aim to over rather than under-expose and develop to a full strength.

543. **Plates.**—While ordinary and slow plates are best for general copying, very good originals are improved sometimes by using an Isochromatic plate. Pictures that are old and stained should never be copied with any color-sensitive plate (Isochromatic or Orthochromatic), as these plates tend to show the blemishes much more strongly, being sensitive to the different colors which are found in old pictures. By the use of slow Orthochromatic plates you can make better copies from a fine print, one full of half-tones and color-value, but never use them on old or faded yellow and marred prints, for these plates are sensitive to the different color values and the defects will appear more prominent in the copy than they were in the original. It is advisable to use a slow plate for the reason that slow plates have more latitude both in the exposure and development. A slow plate when over-exposed can be handled much more easily in correcting the exposure during development. There is also less danger of over-exposing a slow plate. Generally speaking, the slower the plate the finer the grain of the emulsion. For the use of special prepared plates and special copying, see Chapters XX and XXI.

544. **Developing.**—All copies having a full exposure must be treated as such, developed slowly and considerably further than ordinary work would require. In order to avoid fog, and retain the snap throughout the development we advise using three or four drops of a 10% solution of Bromide to your normal developer. Mix well and proceed to develop in the usual manner. Remember that plates from copies should be carried at least one good shade farther in developing than regular work. Work very carefully and once you have made a good copy you will have a

good key to guide you in your future work. Great care must be exercised when developing color-sensitive plates. Either cover your developing tray or develop away from the ruby-light. When examining the plate during development, do so as quickly as possible, as the plate is sensitive even to ruby-light, and will fog in a few seconds.

545. Remember, color-sensitive plates are extremely sensitive to all colors; keep them in the dark. These plates give the best results when developed in the formula accompanying them and should be handled in that way. The plates after developing should be fixed, washed and dried in the usual manner.

CHAPTER XXIV.

Difficulties—Copying.

546. Placing the Original to be Copied in the Proper Light.—

In arranging the original picture or drawing in position for copying, great care must be exercised that the light does not come all from one side. To get an even illumination the original should *face* the light as much as possible. Unless this is done, the grain in the paper, no matter how slight it may be, will show very strong in your copy. Whether you are using artificial or day light, be careful that the light strikes the picture flat and illuminates it evenly. With a little experimenting, and carefully watching the effect of the light on the picture and your results, you will readily overcome this difficulty.

547. Making Copy Same Size as Original.—If you are using a rectilinear lens and have a long bellows camera, you should have no trouble. Carefully measure the picture and then also measure the image on the ground-glass. If you have no long bellows camera supply yourself with either a reading-glass, or a copying-lens of the kind to be attached to your regular lens. A very good plan is to paste a strip of black paper, exactly 6 inches in length and about $\frac{3}{4}$ inch wide, on the copying easel or support to which you have tacked your original picture. This should be placed on the side of the original and fairly near to the margin. If you desire to reduce your copy say to half its original size, all that is necessary for you to do is to adjust the focusing until the strip measures 3 inches on the ground-glass; or, if you desire to make it three-quarter size, adjust your camera until the strip measures $4\frac{1}{2}$ inches on the ground-glass. This same method can be applied if you desire to make an enlarged copy.

548. Copying Water-Color Drawings.—When copying water-color drawings you will find that, when compared with very dark oil paintings, a dark water-color would require only one-third the exposure, all depending upon the density of the colors.

549. Making Copies from Oil Paintings.—When copying an oil painting never turn the picture upside down in order to focus

it. A painting should be lighted from the same direction as the light used by the artist when painting it. One reason for this is that the painter had a motive in laying every brush-mark upon the canvas. Oftentimes you will find the paint is laid on heavily in order to give certain effects to the shadows which the brush-marks cast, so that if the picture is lighted from a different direction the purpose of the artist is confused. Another reason is that when lighted from the correct direction very little glare, if any, from the surface will be noticed. Sometimes it is necessary to place the picture at an angle to the window, with the result that the exposure must be prolonged. This arrangement of the picture will cause uneven illumination, which may be equalized by placing the picture well to one side of the window so that the near side of the canvas is slightly screened by the window casing. It is *not* a reliable test for reflection to place the head in front of the camera, because the light reaches the eye at a different angle to that at which it reaches the lens. The best plan is to focus the picture, remove the lens and ground-glass and examine from the position to be occupied by the plate-holder.

550. The choice of a suitable plate is a matter requiring careful judgment. There are many excellent brands of Orthochromatic and Isochromatic plates on the market which answer well when fairly fresh but are liable to change their color sensitiveness when kept too long. You must also consider the penetrating colors and use the plate and color-screen which is most suitable.

551. **Securing Sharp Focus.**—Always focus with your lens wide open. Be careful that your picture is placed both perpendicularly and horizontally to your camera. Focus as close as you can and then, if you find it necessary use a stop small enough to give you a perfectly sharp image.

552. **Overcoming Reflection.**—Reflections are oftentimes caused by too strong light striking on some light article or wall-paper in the room, either of which may happen to be at such an angle that the light is thrown on to the pictures which you are copying. A little careful observation on your part—covering up such articles with a dark cloth, or placing a screen between the light object and the picture—will readily enable you to overcome this reflection. If you are troubled with reflections when copying a picture which is framed, the glass should be removed if possible, or, by placing a black screen in front of the camera, with a small hole in it just large enough for the lens, you can readily overcome reflection on the glass. The use of a short focus lens is often responsible for this difficulty, as, the angle of view being a wide one, objects in front and a considerable distance from it on both sides are reflected onto the lens. Here again you will find the hood a very convenient

accessory. Using a long focus lens the camera can be placed at a greater distance, thereby lessening the danger of reflection.

553. Overcoming Distortion.—Distortion is generally caused by the picture not having been placed perfectly parallel to the ground-glass. If it is turned a trifle to one side or tipped backward, or forward to the camera you are bound to produce distortion. Adjust your camera and picture carefully, having them both perfectly aligned, and you will readily overcome this difficulty.

554. Overcoming Grain of Paper in Original Picture.—In some cases it is impossible to overcome the grain entirely, but careful lighting, use of proper plates, full exposure and full development will make it possible to at least not show the grain any more than it appears in the original picture. The lighting, exposure and development are important factors to be dealt with under such circumstances. (Read instruction carefully.)

555. Securing Proper Exposure.—Only practice and close observation will enable you to judge proper exposure. Keep a memorandum of your exposures, noting carefully the conditions of light, length of exposure, and whether the plate appears to be under or over-exposed when developing. Examine your results carefully and then govern yourself accordingly the next time you are copying a picture under the same or similar conditions.

556. Plate Develops Flat.—This is almost a certain sign that the plate was very much over-exposed. If the plate flashes up quickly in the developer you must immediately take means to overcome the effects of this extra over-exposure by restraining your developer. See instructions for developing over-exposures, Vol. II.

557. Plate Develops Thin.—A plate that develops thin and cannot be carried further in the developer is an extremely under-exposed plate, while if thin and the shadows are filled with detail it is extremely over-exposed but under-developed. In either case treat your plate according to the exposure, when developing, and always carry copy-negatives a little farther in the developing than you would other exposures.

558. Determining What Plate to Use.—If you follow the instructions carefully and observe the results you obtain, after a few experiments you will be able to readily determine what plate you should use. For colored pictures you are told to use Isochromatic or Orthochromatic plates. As a rule, for black and white subjects and engravings it is advisable to use ordinary slow plates.

559. Determining What Size Stops to Use.—Never use a stop smaller than is absolutely necessary to produce a sharp image. For copying drawings, engravings, etc., in which extremely fine lines are to be reproduced, it is advisable to use a small stop

as this will prevent the clogging of these very fine lines. You will find that when you desire to produce contrast it is always advisable to use a small stop.

560. Knowing What Lens to Use.—If you are fortunate enough to own a number of different lenses, the selection of the right one might be a difficulty. A single lens is not to be recommended unless you are making a copy much smaller than the size of the plate it is made to cover and, even then, you will find it will be necessary to use a small stop. An ordinary Rapid Rectilinear Lens will be found to fill the requirements, but it must be used in a good light to make up for the loss of illumination when it is stopped down sufficiently to cover the extreme corners of the plate. When, however, a color filter has to be used in a dark or poorly lighted room this type of lens is almost worthless. The very best lens for copying is one of the anastigmat type because of its exceedingly flat field and its freedom from distortion when used at full aperture on the size of plate it is listed to cover.

561. Obtaining an Image the Size of the Original.—When a small and short focus camera is used there is no attachment that will give you such good service as the Ideal Copying Lens, which slips over the regular lens and shortens the focus at least one half. By means of this lens any hand or view camera can be used for copying and an image the same size or larger than the original can be made, providing the original is not larger than the size plate your camera will hold.

CHAPTER XXV.

Bromide Enlarging by Daylight or Artificial Light.

562. **Introduction.**—While Bromide enlarging is perhaps one of the most interesting and profitable branches of the photographic business, yet many have an idea that the making of Bromide enlargements requires an expensive apparatus, and a great deal of time and technical skill. Such is not the case, for you can practically provide the necessary apparatus yourself.

563. The advantages of Bromide enlargements are many. For the *professional*, it enables him to make many of his negatives on small plates, with quicker exposures, and with a large percentage of successful ones, at one-quarter the cost of larger size plates, and at the same time avoid the inconvenience of handling a large and unwieldy camera when quickness is important.

564. Again, many times when these enlargements are made from your small negatives of good customers you would have no difficulty in disposing of them at a good price. This is especially the case with negatives of children. In fact, many photographers make it a point to finish an enlargement from one of the negatives out of every order, especially where the customer is to call for the completed work. When delivering the order, the customer is shown a Bromide enlargement from the same negative and at once becomes interested, resulting in not alone a sale of the enlargement at a good price, but very often, a suitable frame for it as well, all of which add to the photographer's receipts, with but little effort and a slight extra expense.

565. For the amateur, Bromide enlarging is a great

convenience, for by its means beautiful enlarged pictures can be made from any small negative, and made by the amateur himself, without any additional apparatus other than such as he can prepare alone. In other words, his hand camera can be made to serve as an enlarging camera, providing it is of the adjustable focus type and the back is removable or has a ground-glass for focusing.

566. Box cameras or cameras of fixed focus can also be used, provided the back can be removed. In this case, a dark cloth should be attached to, or placed around, the back of the camera, giving it extra focal capacity.

567. The principal advantage of enlargements for the amateur lies in the fact that he requires but one camera for all purposes. In place of being loaded down with a large camera, a medium size instrument will serve him for any and all purposes, and whenever he desires a larger picture than the size of the original negative, he simply makes an enlargement from the negative.

568. Then again, an enlargement is often much softer and better than a direct print, for one has the advantage of manipulating in the exposure by holding back such portions as are desired lighter, and exposing longer other portions which are preferred printed darker. There is the further advantage of printing clouds into the scenery, or taking negatives which are perfectly sharp and making diffused, softer pictures from them.

569. **Bromide Enlarging Briefly Described.**—Bromide enlargements from small negatives are obtained by exactly the reverse method employed in making the original negative. The original negative was made by means of a camera and lens, where the rays of light reflected the image through the lens into the camera, registering it upon the sensitive plate. Enlargements from a small negative are obtained by placing the negative in the rear of the camera, in the place formerly occupied by the plate-holder, and then permitting the rays of light to pass through the negative, then through the lens, and finally focusing on a sheet of sensitized Bromide paper, the size of the projected image de-



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pending upon the distance between the lens and the sensitized paper. The farther the paper is from the lens the greater the enlargement.

570. The amateur who has not had previous experience in making enlargements may, at first, be puzzled to know why only particular kinds of sensitized papers can be employed for the work. He has learned to use printing-out papers and gaslight papers for contact prints and may be tempted to apply his knowledge of these to the extent of using them for enlargements. But for this work printing-out papers are entirely out of the question and gaslight papers suitable only when a very strong source of light is available—in other words, a sensitized paper, possessing much greater sensitiveness to light than printing-out papers, is needed, and for this reason, in contact printing, the paper is placed in, practically, optical contact with the negative. The light passing through the negative has full play on the paper and is not weakened by having to travel any distance.

571. In enlarging, the negative is, necessarily, at some distance from the paper on which the print is made. As light reduces in strength in the ratio of the square of the distance it has to travel, it requires a very much longer time, or a very much stronger light to create an image on paper which is at any distance from the negative.

572. Certain salts of silver, notably Bromide of Silver, are much more sensitive to light than others, such as Chloride of Silver, which latter is used in the manufacture of printing-out papers. Owing to the nature of Bromide of Silver salts it is utilized for such papers as are needed for enlargement work, which, as a general term are called Bromide papers.

573. Gaslight papers, which are a species of *slow* Bromide papers, can also be used for enlarging, but as their speed is roughly fifty times less than that of normal Bromide papers they require a fifty times longer exposure. Otherwise the handling of Bromide papers and Gaslight papers for enlarging is virtually the same.

574. Bromide papers compare in speed with very slow dry plates, consequently, need to be handled with all the precautions as to light fogging that are observed with dry plates—in other words, they must be used in a dark-room, under ruby or yellow light.

575. In the subsequent instruction the following methods of procedure for making enlargements are supplied: Using a regular enlarging lantern; employing an ordinary view camera used as an enlarging camera; using hand or pocket folding cameras; and professional methods such as are employed in studios, using the arc-light with and without condensers. We include therein, also, the use of the Aristo lamp. In all of the instruction we provide for the use of daylight as well as all kinds of artificial light, so that the reader may select any method described which will suit his or her convenience. An example of enlarging is shown in Illustration No. 7.



Illustration No. 7.
Example of Enlarging
See Paragraph No. 575

CHAPTER XXVI.

Grades of Bromide Paper and Their Use.

576. Before entering upon the detailed instruction we will first give a description of the different grades of paper to be used. Bromide paper is a pure photographic paper coated with a sensitive emulsion composed principally of pure bromide of silver and white gelatin, only enough gelatin being used to cause the sensitive silver salt to adhere to the paper. The Bromide of Silver emulsion is so compounded that it will give a pure black tone when exposed to light for a brief period of time and then developed, the unexposed portions of the paper remaining perfectly white except in the papers of the class of Royal Bromide, which has a delicate cream tint.

577. **Grades of Paper.**—Bromide papers are manufactured in different grades and qualities, ranging from a heavy rough to a thin smooth in the matte surfaces and in the glossy papers from the enameled to the matte-enamel. Each of these various kinds of Bromide papers are generally made in two varieties of emulsion marked either “hard” or “soft.” “**Hard**”—strong contrasts for use with soft or flat negatives. “**Soft**”—soft and rapid for use with hard or strong, contrasty negatives. The papers manufactured by the Eastman Kodak Company are probably the best known and can be used as a standard.

578. **Platino-Bromide paper** gives Platinum-like results. It has a fine surface and is best adapted for enlargements from original negatives—not copies. This paper is made in two weights—A, thin smooth; C, heavy rough. The C, heavy rough, is intended for enlargements of more

than ordinary size which are to be spotted or finished in crayon, pastel, India-ink, water-colors or oil.

579. **Standard Bromide paper** is adapted for all kinds of enlargements, particularly copies on which crayon or pastel work is to be done. The emulsion is coated on three different weights of paper—A, thin smooth; B, heavy smooth; C, heavy rough.

580. **Matte-Enameled Bromide paper** gives rich carbon blacks and has a smooth, velvety, matte surface, tinted just enough to lend warmth to the high-lights and half-tones, giving an effect not heretofore obtained with Bromide papers. When used with a negative made direct from a subject—not from a copy—enlargements can be made that closely resemble matte contact prints.

581. This paper gives excellent sepia tones, and is especially recommended when it is desired to make plain prints without hand work for enlargements 16 x 20 and under. It is furnished in medium-weight only.

582. **Enamel Bromide Paper.**—A glossy Bromide paper, which, when used with direct negatives—not copies—gives enlargements closely resembling glossy contact prints. It affords excellent sepia tones and can be finished in water-colors washed in by brush or with the air-brush. When squeegeed to a ferrotype plate a gloss is produced which is fully equal to that produced by the glacé process. It is furnished in medium-weight only.

583. **Royal Bromide Paper.**—Sepia-toned enlargements made through bolting cloth on Royal Bromide paper have the softness and beauty of rare old etchings. Owing to the broad effects we do not recommend this paper for pictures smaller than 8 x 10 inches.

584. Negatives having dark, sketchy backgrounds, deep shadows and snappy high-lights will combine to produce an effect with Royal Bromide not obtainable with any other Bromide paper.

Royal Bromide is not intended for use when vignetted prints with white backgrounds are wanted, for it is coated on paper having a delicate cream tint, the yel-

lowish cast in the high-lights harmonizing beautifully with dark backgrounds, but not adapted to vignettes. This is made in two varieties, rough and smooth.

585. **Velvet Bromide.**—This product is suited to negatives having broad shadows, the slight sheen of the semi-gloss surface giving the enlargements from such negatives a life and brilliancy which is highly pleasing. Velvet bromide is especially suited to enlargements from amateur or landscape negatives.

586. **Keeping Qualities of Bromide Papers.**—Bromide paper has exceptional keeping qualities, its life being about the length of any of the gaslight papers. It should be kept in a dry, well ventilated cupboard or drawer.

587. **Purchasing Paper.**—For the convenience of consumers these papers are put up in all standard sizes, and for the amateur, or the photographer who is using small quantities we would advise the purchase of these cut sizes. They are put up a dozen in a package, the smallest of which is $2\frac{1}{2} \times 2\frac{1}{2}$ and the largest 40×72 inches. For those who are using large quantities we would advise purchasing in rolls. They are put up in 10-ft. lengths $24\frac{1}{2}$ inches wide, and in 10-yd. lengths, of four different widths,

20 inches wide

24 inches wide

30 inches wide

41 inches wide

When ordering always specify whether you want the "hard" or "soft."

588. **Sensitiveness of Bromide Paper.**—While Bromide paper is considerably more sensitive than gaslight or developing papers, such as Velox, it is only about half as sensitive as a rapid dry plate; therefore it can be handled in a fairly strong yellow or ruby light, but never in extremely weak daylight, as this would fog it. Daylight coming through two thicknesses of postoffice paper is a perfectly safe light to work by. When artificial light, such as gas, or kerosene, is used, one thickness of postoffice paper over the light will be sufficient and perfectly safe.

588a. **Enlargements on Special Velox Paper.**—Very excellent results are obtained by enlarging on special velox. This paper, being much slower than the bromide, requires about *fifty to sixty times* the exposure of that necessary for bromide paper.

588b. **Enlargements on Nepera Paper.**—Nepera is a developing paper, and, like the velox, is much slower in speed than the bromide paper, but it possesses qualities that recommend it particularly to the professional making high-class portrait enlargements. Nepera is unequalled as a paper for enlargements from professional portrait negatives, as it fully preserves all the detail and delicacies of gradation of the original negative. Royal Nepera produces exceedingly rich sepia tones when redeveloped. The great variety of surfaces and grades of the Eastman permanent Bromide and Nepera papers enable the photographer not only to duplicate any effect to be had in contact printing, but also in many instances to greatly improve the quality by means of simple manipulations during exposure and development. Enlargements from good negatives made on the proper grade of paper will equal in every respect a contact print made from an enlarged negative, and with a great saving of time and money. In fact, many photographers prefer making all their negatives of uniform size, and when they receive orders for large prints, enlarge from the small negatives with equally satisfactory results.

588c. The same developer can be used for Velox or Nepera enlargements as for bromide paper, but an acid hypo bath should be used for fixing, as follows:

Water	2 qts.
Hypo Sulphite of Soda.....	1 lb.

When thoroughly dissolved, add 6 ozs. of the hardening solution, prepared as follows:

Water	10 ozs.
Sulphite of Soda (desiccated).....	1 oz.
Commercial Acetic Acid.....	6 ozs.
Or 1½ ozs. Glacial Acetic Acid	
Powdered Alum	2 ozs.

Prints when developed should be quickly rinsed and immersed in the hypo bath. A freshly made acid hypo bath will fix prints in twelve minutes.

CHAPTER XXVII.

Brief Instruction for Bromide Enlarging With the Enlarging-Lantern.

589. Enlarging-lanterns are constructed for use with artificial light. Either electric, gas or kerosene lamps can be used. Illustration No. 8 shows the Ingento Enlarging-Lantern. The end of the apparatus containing the lantern is fitted with large Russian iron light chambers which accommodate any of the artificial lights you may wish to employ. The bellows and lens-board move on rigid and finely nickeled rods. The frame-stage which receives the negative-carrier is open on the top so that it can be used with negatives larger than those to which the lantern is especially adapted, and as it is perfectly square the negative can be used vertically or horizontally.

590. The condensing lenses are located between the negative-carrier and lantern. When using the enlarging-lantern all that is required is an ordinary room made perfectly dark, a table upon which to place the lantern, and another small table upon which to place a good sized box to be used as an easel, which will support the sensitized paper. The side of the box facing the lantern should be covered with white cardboard, which may be marked off with a pencil in various sizes, 8 x 10 to 16 x 20 inches. These markings or guides will aid you to obtain the correct size enlargement desired.

591. To operate the instrument, light the lantern and then place the negative in the negative-carrier. Place the table containing the box which is to carry the Bromide paper (and which hereafter will be referred to as the easel) within three feet of the lens and directly in front of and

square to it. To obtain a focus, rack out the bellows until the image appears sharp on the white card on the easel. If the image is too small place the easel farther away. The

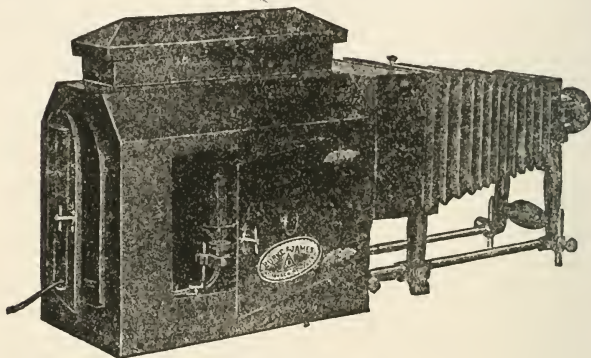


Illustration No. 8
Ingento Enlarging-Lantern
See Paragraph No. 589

size of the image depends upon the distance between the easel and the lens.

592. When you have obtained the focus, cap the lens and with thumb-tacks attach the Bromide paper to the easel. You are then ready for the exposure, which will vary from 20 to 60 seconds according to the light employed and quality of the negative used.

593. After the exposure the print is removed from the easel and is ready for development, which we will treat of later.

CHAPTER XXVIII.

Daylight Enlarging With a Pocket Film Kodak.

594. The Folding Pocket Kodak is arranged before a window in exactly the same manner as a larger camera, but as it is not provided with a flat-bed to rest on any flat surface, a frame must be constructed to hold it in place against the window. A very convenient frame, to which the kodak is fastened by stout rubber-bands, is shown in Illustration No. 9. This frame is attached to a board, fastened across the window and containing an opening not larger than the back of the kodak.

595. Other pocket film cameras, which are made with drop fronts providing a flat-bed, can be used of course, in the same manner as the regular hand or view cameras.

596. The frame, as seen in Illustration No. 9, is easily constructed, consisting of a box made of one-half inch pine lumber, about 3 inches deep, by the width of the camera and the length of the film employed, with a projection on the front extending $1\frac{1}{2}$ inches at the top and 2 inches on the bottom. Attached to the bottom is a wooden strip 3 inches wide used as a shelf upon which the end of the camera rests, which is held in position and in close contact with the frame by means of heavy rubber-bands slipped over the extension and camera—both at the top and at the bottom. The rear of the box, which is intended to face the window, contains grooves to receive the negative. The inside of the box is stained dead black. This extra box attachment also serves to give more focal length to the camera and thus enables you to make larger pictures with it than without it.

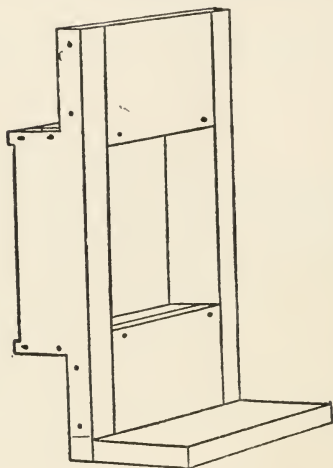


Illustration No. 9
Enlarging Frame to Hold Kodak
See Paragraph No. 594

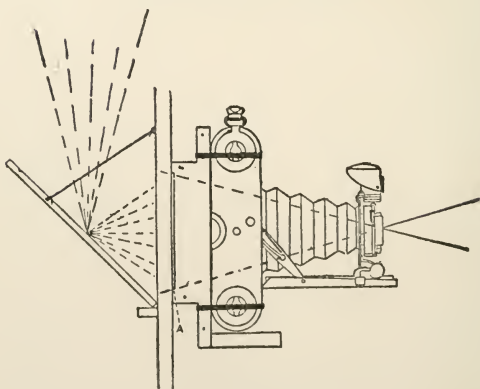


Illustration No. 10
Kodak Attached to Frame
See Paragraph No. 597

597. Illustration No. 10 shows a camera and holding-frame in profile and illustrates the method of holding the camera in position with rubber-bands.

598. To place the negative in position for enlarging, procure two pieces of plain glass to fit the opening, A, in the holding-frame. See that the glasses employed are with-

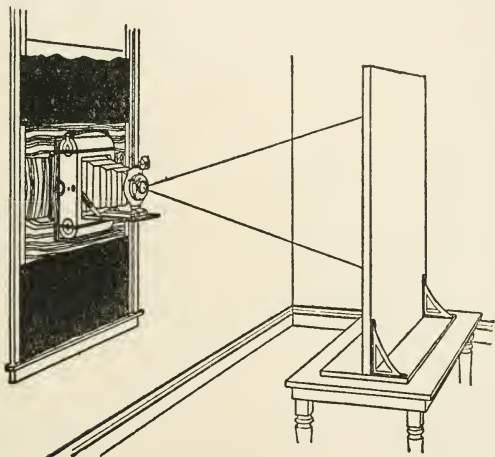


Illustration No. 11
Kodak in Position
See Paragraph No. 598

out flaws and perfectly clean. Place the negative to be enlarged from between the glasses, binding the ends of the glasses with a small piece of adhesive tape to insure the film negative lying flat. Then insert the glasses and film in groove A, with the negative upside down and with the dull (film) side facing into the room. Next remove the back from the camera (as it will not be used while enlarging) and place the camera in the holding-frame, as shown in Illustration No. 11, securing it to the frame with heavy

rubber-bands. By using rubber-bands the camera is held in position without danger of marring or scratching the leather covering.

599. In many instances, the actual picture is contained in a comparatively small portion of the negative and in such cases all undesirable portions may be covered with a mask of black paper. In order to be certain that no light enters between the camera and the holding-frame an opaque cloth should be wrapped around the camera and frame.

600. **Size of the Enlargement.**—The size of the enlargement depends upon the focus of the lens and the distance of the easel or copying-board from the negative.

601. **Lens.**—Any lens that will make a good negative may be used for enlarging. The proper size (focal length) of the lens depends entirely upon the size of the negative to be enlarged from and not at all upon the size of the enlargement to be made.

602. The lens that made the negative will be suitable for making the enlargement. If the lens will cover the negative it will make an enlargement from it of any size. The regular lens fitted to any hand camera is suitable for enlarging from negatives made with it.

CHAPTER XXIX.

Daylight Enlarging With the View or Hand Camera.

Detailed Instruction.

603. **Preparing the Apparatus.**—To prepare your apparatus for daylight work is a very simple matter. Select a room with a window facing north, if possible, a room that has only one window in it. If there is more than one window, all except one must be covered with black opaque material and made absolutely light-tight. The accompanying Illustration No. 12 will serve to show how to construct, very cheaply, an enlarging apparatus with an ordinary view camera converted into an enlarging camera. First procure two boards $\frac{1}{2}$ in. thick, about 18 in. wide, and as long as the width of the window. Attach one of these boards to the sill of the window that you propose using, fastening it so that it will act as a shelf. Fasten the other board across and against the window sash with the lower edge resting perpendicularly on the shelf. Next place your camera on the center of the shelf with the ground-glass against the upright board, and with a pencil mark an outline for an opening in this board just a little smaller than the outside measurements of the camera. Cut out this opening; then tack a heavy opaque cloth (large enough to cover the camera) around the opening so as to form a sleeve. This will close all openings around the edge of the ground-glass and camera-back.

604. When the balance of the window is covered with heavy press-board or opaque cloth no light will be admitted into the room except that which comes through the ground-

glass and lens. The camera should be placed within an inch of this opening, allowing for the thickness of the plate-holder between the ground-glass and camera and should

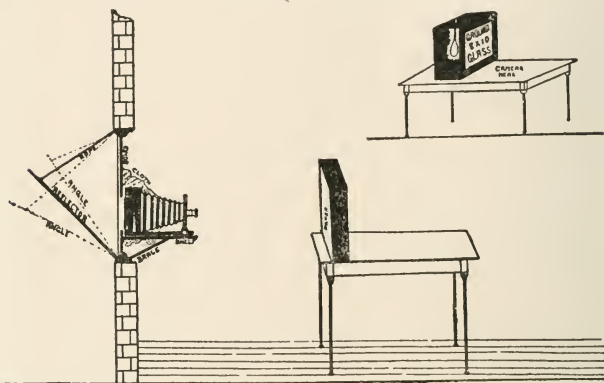


Illustration No. 12
Enlarging Box for Daylight
See Paragraph No. 603

be covered with the cloth so that no light enters except that which passes through the back of the instrument. Before attaching your camera to the window and shutting out all light you must fasten a reflecting-board about 18 x 24 inches on the outside of the window, and six inches below the bottom of the opening in the board. Cover it with white cardboard, and fasten a cord to each side of the center of the outer edge of the board and to each side of the window-frame, to hold the board in place.

605. Where the window, at which the camera is arranged, is not obstructed by buildings or trees which interfere with the direct passage of the light through the negative and lens, no reflecting-board is needed. But, where a clear view to the sky from the window is not to be had, as for instance in cities or closely built up districts, the



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STUDY No. 10—See Page 357

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light from the sky must be reflected into the camera at such an angle that the rays pass through parallel to the axis of the camera and lens. This can only be accomplished by placing the reflecting-board at an angle of 45 degrees

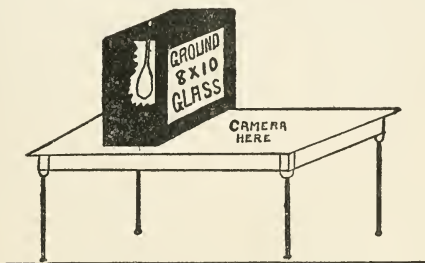


Illustration No. 13
Enlarging Apparatus for Artificial Light
See Paragraph No. 606

to the window. A window should be chosen into which the sun does not shine.

606. Preparing Apparatus for Artificial Light.—Bromide enlargements can be made equally well at night by the use of artificial light, although the necessary exposure will be considerably longer. In this case you can use your regular dark-room. The accompanying Illustration No. 13 will serve to show how to prepare a box for the use of electric light. A good, large box should be used in order to keep the bulb cool, and the hole in the top of the box, through which the electric cord enters, must be protected by a bushing. This can be done by using a 2-inch piece of rubber hose or tubing. Fit this in the top of the box and pass the electric cord through it. A good plan is to also have a small door in the back of the box, through which you can turn the light on and off. To make this box absolutely fire-proof and safe, line it with asbestos, more especially if it is rather small. If it is a fair sized box, line it with tin and it will be perfectly safe, while the tin will act as a

reflector and increase the strength of light. The front of the box should be fitted with a sheet of ground-glass. Set the box on a table and then place the camera in front of the ground-glass, exactly the same as when using the window.

607. In case your dark-room is very small and you have no electric light but must use some other artificial light (lamp light for example), then prepare your dark-room so that you can place your lamp on the outside of the door or one of the walls, about three feet from the floor, with an opening cut in the wall large enough to receive the ground-glass or negative space of your camera. Build a shelf both on the inside and outside of this opening, the one on the inside to hold the camera and the one on the outside to hold the box containing the artificial light.

608. The box containing the light must be lined with either asbestos or tin. This lining will answer three purposes—it concentrates the light, acts as a reflector, and also makes the box fire-proof. A ground-glass must be fitted in the one side facing the dark-room. If it is possible, use an opal glass in place of ground-glass. This is a milk-white glass, with which, you will find, you will produce a whiter and more evenly distributed light. This ground-glass or opal glass is to take the place of a condenser and if your light is placed far enough away from the ground-glass it will diffuse evenly. The correct distance between the light and the ground-glass is twice the diagonal of the negative employed. This extra ground-glass is not necessary when using the ground-glass which is on the camera.

609. Any kind of light can be used. If electric light can be had then drop two 32 candle-power incandescent lights into the box, one in each corner and some little distance to the rear so as to bring the lights away from the ground-glass as far as possible. If no electric light can be had, two gas jets or two kerosene lamps will do. If the latter are used it is necessary that there be two openings at the top of the box to give draught to the chimney. A low lamp is best as the flame will be centered more evenly.

610. Where electric light is used and the dark-room is sufficiently large, there will be no necessity of cutting a hole in the wall and placing the light on the outside, as the box containing the electric light can be made entirely light-tight and can be used inside of the dark-room. If gas or kerosene light is used you could not close the box entirely as both must have some air to burn well and give white light.

611. When using kerosene we would advise placing a piece of camphor, about the size of a walnut, into the oil.

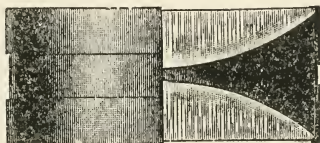


Illustration No. 14
Condensing Lens
See Paragraph No. 612

This camphor will cause the oil, when burning, to give a whiter—more actinic—light.

612. **Condenser.**—This is a very large lens and is used in place of the ground-glass. It consists of two plano-convex lenses mounted with the convex faces inwards. See Illustration No. 14. This lens collects all the rays of light together, passes them through the negative and brings them to a focus in the lens which projects the image. Large condensers if made of fine glass are quite expensive, but a cheaper grade can be procured, producing equally as fine results if a sheet of very fine ground-glass be mounted between the convex surfaces of the two lenses. This, however, is intended of course, only for large condensers and where electric light is used. Electric light gives a stronger light than is actually required; the diffusion caused by the ground-glass therefore is no detriment.

613. As all the light must come through the con-

densing lens and the negative from which the enlargement is to be made, the diagonal of the negative must not be any larger than the diameter of the condenser; otherwise the corners of the negative would be cut off. For all negatives up to 5 x 7, a 9-inch condenser will answer; a 10-inch condenser would be better. The latter size is more generally used than any other. The size of the condenser has nothing to do with the size of the enlargement. It has only to deal with the size of the negative you wish to enlarge from, as it collects and concentrates the light upon the negative and distributes it evenly. Any size enlargement can be made with any size condenser so long as the condenser is large enough to cover the negative from which you are enlarging. Where a condenser is used in place of the ground-glass the light, being concentrated, is so much stronger that the exposure necessary for the enlargement is reduced considerably. Any kind of light can be used with the condenser exactly the same as if the ground-glass were used. Electric light, however, is preferable to lamp light and if incandescent bulbs are used the box, as shown in the cut, can be arranged to hold the condenser in place of the ground-glass.

614. **Enlarging Easel.**—On a small table or stand place a box a little larger than the size of enlargement you are going to make. Fasten this box down by some weight (place some heavy material inside) so that it will be perfectly rigid. This box will serve as an easel on which you can fasten the Bromide paper. The side of the box facing the camera should be covered with a piece of white cardboard, or cotton cloth which should be soft and perfectly smooth. A good plan, where cotton cloth is used, is to dampen it before you tack it to the box and then use plenty of tacks. When it becomes dry it will be as tight as a drum-head.

615. A more elaborate apparatus and a style usually used in the professional studios can be constructed, as shown in Illustration No. 15. The easel-board can be made to slide up and down in the frame and is held in position at

any desired point by means of a flat spring attached to each side of the board and working in the groove between the board and the upright standard. The base of the easel can also be mounted on a track if desired for sliding backward and forward, nearer or further away from the camera, but this is not necessary and is not very generally used except in specially prepared enlarging rooms that are used for no other purpose. Easels may also be purchased from any photographic supply house. The Ingento Enlarging and Copying Easel is shown in Illustration No. 16, page 231.

CHAPTER XXX.

Light for Enlarging.

Part I.

Introduction.

616. **Daylight.**—After a long series of experimenting with various kinds of light we have become satisfied that for the amateur—whose enlargements are only made occasionally—the daylight method is the best to employ. Daylight requires no extra apparatus, as any ordinary view or hand camera is all that is necessary, whereas for artificial light more preparation is required. One of the drawbacks to daylight, however, is that many do not have the time to work during the day and must make their enlargements at night—hence the necessity of using artificial light.

617. Another drawback to daylight is that it varies in intensity, rendering the timing of exposure somewhat difficult. It is, of course, weaker in the early morning than in the middle of the day. Possibly, too, while making the exposure the sun becomes obscured by a cloud. This objection, however, you will readily overcome by always trying a small test piece of paper on each subject before making the full size print.

618. When using daylight, you must provide yourself with a good sized reflector, so that the light will be reflected evenly on the ground-glass. This should be arranged on the outside of the window, so as to throw the light coming from above onto the ground-glass. To ascertain whether this is in the proper place, take out the lens and

examine the ground-glass from inside the dark-room. If the ground-glass appears evenly illuminated your reflector is properly adjusted; if the sun shines on ground-glass and reflector, providing it strikes evenly, it will do no harm. If the light is too strong the lens can be stopped down. You will find that a mirror will produce strong reflection, making the light much more powerful; and in case of using a lens of small aperture, this would be desirable, as the mirror will reflect the rays of light from the sky and give a more even, uniform, and stronger light than any other reflector. If the sun strikes the mirror it should be covered with white paper.

619. **Electric Light.**—Where condensers are used electric light will give a stronger light than is actually required. You may diffuse this light by placing a piece of ground-glass between the condensers. The slight loss of light caused by the ground-glass is no detriment. When the Folmer and Schwing, or the home-made outfit, with the cone and ground-glass (described later) is employed, you will produce softer results and you can diffuse as much as you like with additional ground-glasses. All that is required when you want more contrast is to use a less number of ground-glasses.

620. **Gas and Kerosene.**—While gas and kerosene are hardly powerful enough for enlarging, except on a small scale, very nice results can be produced, but longer exposures will be required of course.

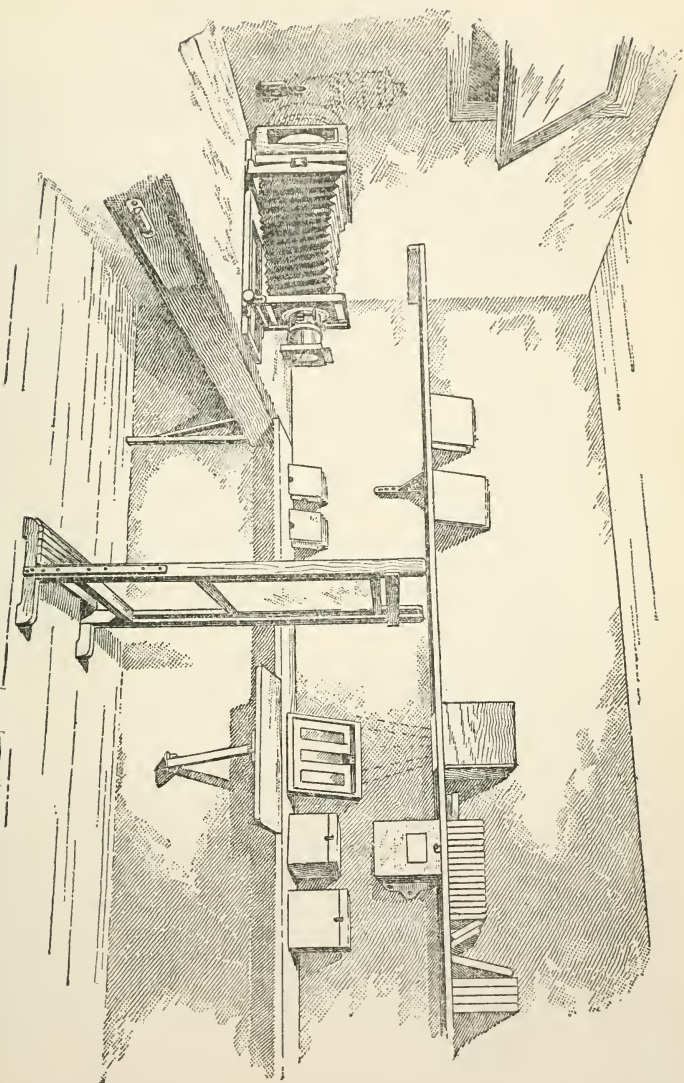


Part II.

Arc-Light for Enlarging in the Professional Studio.

621. **Condensing Lenses.**—In Illustration No. 15 is shown a section of a dark-room used for Bromide enlarging. The camera employed is an ordinary view camera, and the illumination is supplied by an electric arc-light hung on

Illustration No. 15—Section of Dark-room Used for Enlarging—See Paragraph No. 621



the outside of the partition. Fitted in the partition and between the arc-light and the camera is a pair of 9-inch *condensing lenses*, and in the space for the plate-holder is fitted a negative-holder, which operates exactly the same as a plate-holder.

622. **The Negative-Holder.**—The negative-holder consists of a wooden frame fitted with different size kits to hold different size negatives. The holder is so constructed that the kits can be used upright or crosswise. A very practical and inexpensive negative-holder may be made by using an old discarded plate-holder, cutting out the division which separates the two plates when used as a double holder. This holder may then be fitted with the regular kits used for plate-holders, so any size plate may be employed, from 4 x 5 to 8 x 10 inches, and, as the ground-glass frame of the regular view camera is reversible, the holder may be inserted in an upright or horizontal position, by simply inverting the ground-glass frame which receives the plate-holder. When using the condensers, of course you dispense with the ground-glass but use the frame, for the spring frame will be required to hold the plate-holder, containing the negative, in place.

623. The lens employed is an old style 4-4 Darlot Portrait Lens. Over the front flange is fitted a wooden block, with an opening as large as the lens. The face of the block contains a groove, into which is slid a piece of ruby glass, which is used in front of the lens when pinning up the sensitized Bromide paper.

624. After focusing the image on the screen the ruby glass is slid into the groove, excluding all white light, but supplying sufficient non-actinic light to enable you to attach the Bromide paper to the easel, without fogging the paper. When ready for the exposure, first turn off the electric light, by means of a switch to the left of the camera, and then withdraw the ruby glass from the groove before the lens. Then turn on the light and make the exposure.

625. **Folmer and Schwing Enlarging Camera Without Condensers.**—Generally it has been thought necessary,

when making enlargements, to have apparatus fitted with condensers, in order that the best of results may be secured. The expense connected with the fitting up of an apparatus that will take negatives up to, and including, the 8×10 size, or even the 5×7 size, is more than the average photographer cares to incur. The Folmer and Schwing Enlarging Camera does away entirely with condensers, using ground-glass in their place to distribute the light evenly over the whole surface of the negative.

626. Although this enlarging camera is intended to be used with an arc-light, it is possible to employ it with daylight or any other source of illumination. The most important factors, however, to be taken into consideration in selecting an illuminant are, first, the strength of the light, and second, its uniformity. The light should be strong enough to permit of short exposures when using a small stop, and also be perfectly uniform, so that an exact amount of exposure may be given a negative, at any and all times, to produce identically the same results.

627. Daylight varies in its intensity not only every hour of the day, but seldom on any two days is it exactly the same. The Aristo lamp or any arc-light will be found a very satisfactory form of illuminant, as either gives a uniformly even light.

628. Illustration No. 17 shows the Folmer and Schwing enlarging apparatus specially constructed for the purpose. The camera is attached to the inner wall of the dark-room and, fastened to the outer wall, is a cone which connects with the arc-lamp. The bellows of the camera permits of liberal extension, the bed being in telescopic form.

629. The size of the enlargement is, of course, regulated by the focal length of the lens used, and by the distance of the easel—to which the Bromide paper is attached—from the camera. The most perfect prints can be made uniformly and economically by this simple and inexpensive method. A frame is inserted between the back of the camera and the wall, into which the negative is inserted

in position, and in which also one or more sheets of ground-glass are placed. The object of the ground-glass is to diffuse the light and equally distribute it over the negative.

630. The shape of the cone permits of a collection of strong light at the narrow entrance, and as it falls on the ground-glass this will distribute over the entire space, illuminating all portions of the plate to approximately the same degree. By this method it is not necessary to procure expensive condensing lenses, and one may enlarge from 8 x 10, or even larger, negatives by bringing into commission a camera of the proper size and by constructing a cone large enough to carry the rays of light to the negative.

631. It should be borne in mind, however, that the source of illumination must be farther from the negative when employing the larger plate. Under no circumstances should the distance from the light to the plate be less than twice the diameter of the plate. At this distance, however, perfectly even illumination will be secured. The nearer the light is to the negative the shorter will be the required exposure. The current should be turned off when the enlarging apparatus is not in actual use, for the carbon throws off considerable heat when burning, and also uses considerable electricity. It is, therefore, very essential to have a switch located in a convenient place, so the current may be turned on and off at will.

632. A practical arrangement will be observed in Illustration No. 15, which shows a regular section of a dark-room conveniently arranged for enlarging. (See page 227.)

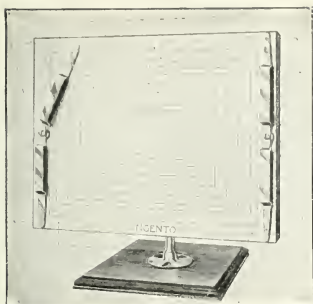


Illustration No. 16
Ingento Enlarging and Copying Easel
See Paragraph No. 615

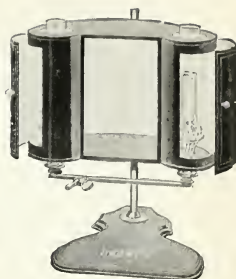


Illustration No. 19
Artificial Illumination for En-
larging and Reduction—
Using Two Lights
See Paragraph No. 880

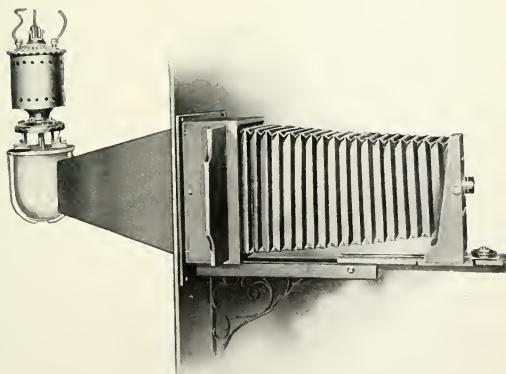
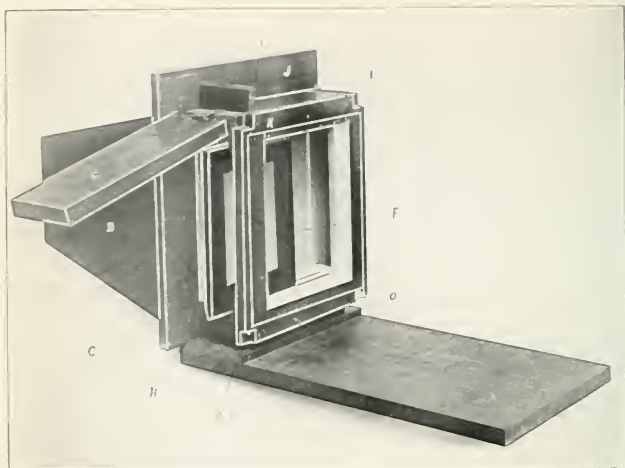


Illustration No. 17
Foimer and Schwing Enlarging Apparatus
See Paragraph No. 628



Home-Made Apparatus without Camera

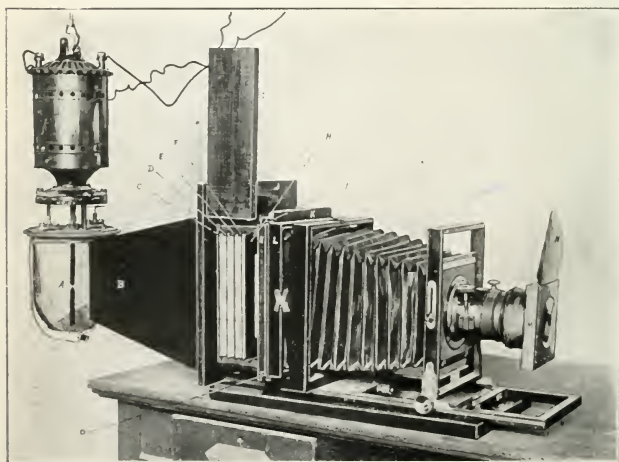


Illustration No. 18—See Paragraph No. 633
Home-Made Enlarging Apparatus

CHAPTER XXXI.

Home-Made Enlarging Apparatus Without Condensers.

633. **Introduction.**—If one does not desire to go to the expense of purchasing a regular enlarging camera, it is possible to construct an enlarging apparatus that will answer the purpose and give practical and satisfactory results. The enlarging box may be built in a manner similar to the one shown in Illustration No. 18. For the camera you can use your regular view camera by removing the ground-glass frame, and by means of the brass clamps that attach the ground-glass frame to the camera, you can attach the camera to the enlarging box. Your enlarging box may be made stationary, if you so wish, and your camera made detachable so you can use it for other purposes. By merely unhooking it from the enlarging box and again attaching your ground-glass frame you have your view camera complete. For this enlarging box it is advisable to select wood that will not warp nor split easily. Of the cheaper woods obtainable, bass wood is recommended.

634. The cone (B) is made of one-half inch material, and for the 8 x 10 camera this cone should be made of four pieces of wood 15 inches long, 12 inches wide at the larger end, and 6 inches at the smaller. In fastening these boards together use No. 4 finishing nails, or long, thin brads. When the cone is completed the inside of the small end will measure 5 x 6 inches, and the cone should be fastened to the body of the enlarging apparatus so that the long way will be upright.

635. Now construct a frame (J) of either half inch or inch material, to be fastened securely to the large end of the cone. This is to act as a flange or casing to fit against the wall, and should, therefore, extend two to four inches beyond the cone, while the inside opening should be 10 x 10

inches in size. After fastening this flange or casing to the large end of the cone, construct a box 4 inches deep, which is to hold the ground-glasses (C, D, E and F) and the negative (H). The inside measurement of this box should be $10 \times 10\frac{1}{8}$ inches, the $\frac{1}{8}$ of an inch being allowed to give a little play for inserting the ground-glasses and negative. In this box provide four grooves for the inserting of ground-glasses and one groove for the negative. A door (G) should be placed at the side and hinged at either top or bottom, as shown in the illustration.

636. The ground-glasses should, of course, be next to the cone, in order that the light may be diffused before reaching the negative. The grooves are supplied by nailing small strips of wood, $\frac{3}{16} \times \frac{1}{2}$ inch in size, both on the bottom and the top of the box, $\frac{3}{8}$ of an inch apart, or far enough apart to permit of the thickest ground-glass or negative being easily inserted and withdrawn. A narrow frame or casing (K) should now be fastened to the edge of this box, to which the camera (L) may be fitted. This should be carefully done, in order that no light escapes between the box and the back of the camera. A small flange may be readily attached to this box so as to fit into the back of the camera in exactly the same manner as the ground-glass back that comes with the instrument. In order to permit of enlarging from an 8×10 negative the opening in this flange should be $\frac{1}{8}$ inch smaller than 8×10 inches.

637. A base-board should now be fastened to the whole apparatus, as shown in the accompanying illustration, so the camera and the balance of the apparatus will fit together perfectly. A careful study of the illustration will enable anyone, handy with tools, to construct this instrument at a cost of not over \$1.50. An 8×10 view camera is an excellent one to employ in conjunction with this home-made instrument, for with this size camera any size negatives may be enlarged from, up to, and including, 8×10 inches.

638. **Full Explanatory Details of Home-Made Enlarging Apparatus Without Condensers.**—(A) electric light;

(B) cone of enlarging apparatus; (C, D, E, F) the four ground-glasses in position; (G) door—hinged at the top; (H) 8 x 10 kit for 5 x 7 plates. 8 x 10 plates are inserted in this same slot without using any kit; (I, O) the upper and lower catches which are on back of the camera, which originally held the ground-glass frame in position, but now utilized to hold the back of the camera to the enlarging box; (J) casing or flange between the cone and the box containing the ground-glasses; (K) flange between box containing ground-glasses and back of camera; (L) back of camera; (M) frame for holding orange colored glass; (N) orange colored glass partly withdrawn.

639. When completed the exterior of the cone and the balance of the apparatus should be painted black, while it is preferable to paint the inside of the cone white, so as to reflect all the light possible onto the ground-glass.

640. If this apparatus is made for 8 x 10 negatives, a kit should be constructed to hold 5 x 7 and smaller negatives. A regular nest of plate-holder kits may be purchased from any supply house, and these used when it is desired to enlarge from negatives smaller than 8 x 10 inches. The largest kit is slightly beveled on the upper and lower edges to fit the grooves, and 8 x 10 negatives are slid in the grooves without a kit.

641. If it is necessary to secure full detail and have a perfectly even distribution of light over the entire surface of an 8 x 10 plate, four ground-glasses should be used. When smaller negatives are employed, two, or even one, ground-glasses usually will be sufficient to give the proper distribution of light. The amount of diffusion necessary depends entirely upon the character of the source of light.

642. **Use of Camera with Daylight.**—If desired, this apparatus can be used for daylight work—*i. e.*, daylight may be employed as the source of illumination. In this case, the window will need to be blocked leaving an opening in it 8 x 10 inches in size. The cone will need to be removed and the balance of the apparatus placed firmly against the opening in the shutter. The same number

of ground-glasses should be used, however, as when artificial light is employed.

643. Always strive to have the light entirely unobstructed. If a building should be opposite your window there would be danger of uneven illumination and it would, in that case, be advisable to place a white cardboard, two feet square, just outside of the window, at an angle of 45° , so as to reflect light from the sky onto the opening. This will give perfectly even illumination.

644. While the professional photographer should have an enlarging apparatus 8 x 10 inches in size, the amateur, or those who have no large camera and desire to construct a smaller apparatus, can do so by using the regular hand camera in place of the view camera and following out the above plans and suggestions. When the small camera is used and artificial light is to be employed the cone will not need to be so long, as the length of the cone depends upon the size of the largest negative from which it is desired to make enlargements. The light, however, should always be as far from the negative as twice the diagonal of the negative.

645. **Lens Screen.**—In making enlargements it is very desirable to have some arrangement that will facilitate the correct placing of the paper on the easel. A simple attachment can be constructed on the lens, similar to the one shown in Illustration No. 18 (M and N), which permits of an orange or ruby glass being placed in front of the lens, through which sufficient non-actinic light will pass to enable you to see what you are doing. After the image has been sharply focused on the easel, the ruby or orange glass is inserted in the groove, and sufficient light will come through this screen to form a slight image on the easel, yet not enough to fog the paper. The attachment shown in the accompanying illustration is made of a wooden block, with a hole cut in the center, and this is fitted over the lens. A groove in the front of the block is made and the yellow glass inserted in this. When the exposure is made this glass, of course, is withdrawn and again inserted at the end of the exposure.

CHAPTER XXXII.

Bromide Enlarging—Detailed Instruction.

646. **Lens for Enlarging**—For professional work the regular lens employed for making portraits may be used for enlarging; all that is required is, that the lens be of sufficient size to cover the plate to be enlarged. Fortunately for the amateur who possesses only a hand or view camera fitted with a rectilinear lens, this is in every way suitable for enlarging; in fact, should be used in preference to others for the enlarging of groups, landscapes, mechanical drawings, etc., and it will work equally as good for portraiture, with the exception that it does not work quite so quickly. This is because it has not as large an aperture. For full and half-length figures it is quite as rapid, because, for this purpose, with a portrait lens it would be necessary to stop down considerably in order to get the entire image sharp. Any lens that will make a negative can be used for enlarging, and the proper size of lens depends almost entirely upon the negative to be enlarged from, and not at all upon the enlargement to be made. If the lens will cover the negative it will make an enlargement from it of any size.

647. A good rule to follow is to use for your enlarging lens the same lens, or the same size lens, that was used to make the original negative from which you are going to make your Bromide enlargement. For portrait enlargements to be made from 5 x 7 negatives, and under, a half-size portrait lens will be found suitable. This lens can be worked nearly wide open for bust pictures, but will have to be stopped down for half or full-length figures.

648. **Quality of Negative Best Suited for Bromide En-**

larging.—Any negative from which a good, snappy, brilliant print can be obtained in contact printing is suitable for Bromide enlarging. By exercising a little care in selecting the proper grade of paper, using "hard" or "soft," as the case may require, almost perfect prints can be produced from harsh and contrasty, or very thin negatives. If only one grade of paper is used, then the difference in quality of negative must be overcome in the exposure and development. A hard, contrasty negative, for instance, must receive a longer exposure than a thin, snappy one, and *vice versa*. All negatives should be carefully spotted, and portrait negatives retouched before enlarging from them; for remember, all blemishes or defects will be very much more noticeable in the enlargement. Also bear in mind that a very badly discolored, yellow negative will necessitate a great deal longer exposure, as the yellow image will have but slight effect on the sensitiveness of the paper; hence the extra long exposure necessary.

649. **Placing Negative in Position.**—We will now suppose that you have your enlarging apparatus prepared for enlarging. Having selected your negative, the next step is to place it in position for enlarging. The negative is placed in the negative-holder upside down, and inserted in the camera with the film side facing the lens, unless you want the image inverted, when, of course, the negative may be placed glass side to the lens. The quality of the enlargement is exactly the same, no matter which way you insert the negative.

650. **Focusing.**—Before focusing, see that your camera and negative are in position, and the room in total darkness, and that the only light coming into the room is passing through the negative and then through the lens. By pushing your easel or stand—which is covered with white cloth or cardboard—forward or backward, you can obtain any size enlargement you want. When you have determined this, focus in the usual manner, by either racking your lens forward or backward. If the lens cuts the image perfectly sharp, and a rectilinear lens will do this, as a rule, you are

then ready to place your sensitive Bromide paper in position. If you find, however, that the lens does not cut the image sharply, it will be necessary to use a stop. Never use a stop or diaphragm smaller than is absolutely necessary. Next place the cap on the lens. This cap should be fitted in the following manner:

651. Cut out the front of the cap, leaving about $\frac{1}{4}$ inch margin around the entire edge. Into this fit a piece of yellow or bright ruby glass. You will find that the image will show on the screen colored yellow or ruby according to the kind of glass you have in the cap. You will also find that the light coming through the colored glass will not affect the paper. After capping your lens attach the paper in position, with thumb tacks, being guided by the colored image on the screen. We would advise the use of Kodak push-pins, as they are made of glass and therefore would not leave so large a white spot on the print. With the paper attached to the board you are ready to make the exposure.

652. **Making the Exposure.**—Before making an exposure on a full size sheet of paper we would advise using a test strip. Take a sheet of Bromide paper and cut it into strips about three inches wide and experiment with one or two of these to obtain the proper length of exposure. In attaching the test strip to the board place it in a position so as to cover portions of the negative containing highlights, half-tones and shadows. This will give you a fair test on all portions of the negative. In this way you will avoid waste. After you have obtained the proper exposure, make a record of the number of seconds on the margin of the negative, which record will be your guide on all future exposures from this negative. The exposure varies with the density of the negative, as well as with the quality and strength of light. A thin negative with sufficient strength to make a good print generally will receive sufficient exposure in one second in diffused daylight, or twenty seconds at a distance of 12 inches from a No. 2 kerosene burner. Very thin negatives should be printed by weak yellow light; in fact, it is better to print weak negatives by artificial light,

as the artificial light always gives more contrast. In this way a fairly strong, vigorous print may be obtained from a negative that would otherwise be too thin and flat. Thin, weak negatives should also be printed on "hard" paper; strong, intense negatives should be printed by daylight, or, at least, by strong artificial light, and on a "soft" grade of paper.

653. The correct time of exposure depends on the negative, the time and brightness of the day, or, if made by artificial light, the strength and color quality of the light. A good way to determine this is to take one of your test strips, tack it on a screen in the manner stated above, then with an ordinary card, cover all but $\frac{1}{3}$ of the strip; take off cap and expose 5 seconds; move the card $\frac{1}{3}$ more and give this 5 seconds; then give the whole strip 5 seconds, thus exposing the first part 15 seconds, the second 10 seconds and the third 5 seconds. Develop the strip and one of these exposures will be a good guide to the correct time. Bear in mind that daylight is about twenty times faster than lamp light.

654. The image must be made to register properly on your box or enlarging easel, by sliding the negative in the holder and by raising or lowering the front of the camera carrying the lens, providing your camera is supplied with a rising and lowering front.

655. *Note.*—In case condensers are being used, the lens must remain on the axis of the condenser and the vertical adjustment obtained by raising and lowering the easel board.

656. Preparing Developer.—

Metol-Hydroquinon Developer.

Hot water	50	ozs.
Metol	$\frac{1}{4}$	oz.
Hydroquinon	1	oz.
Sulphite of Soda (Anhydrous).....	$3\frac{3}{4}$	ozs.
Bromide of Potassium.....	60	grs.
Carbonate of Soda.....	$6\frac{1}{4}$	ozs.

Note: Ortol may be substituted for metol, using the same quantity.

Dissolve the chemicals in hot water, and in order given, and let stand to cool, when the solution is ready for use. To develop, take

Stock Solution	1 oz.
Water	6 ozs.

657. **Fixing.**—A plain hypo fixing bath is recommended, prepared fresh each day, as follows:

Water	32 ozs.
Hypo	6 ozs.

Note: For Velox or Nepera Papers use acid Hypo bath. (See page 208.)

658. **Blisters** sometimes appear on bromide paper, but can usually be avoided by using a little common salt in the first wash water, after fixing. A positive preventative will be found by employing the following fixing bath:

Water	64 ozs.
Hypo	8 ozs.
When dissolved, add	
Metabisulphite of Potash.....	$\frac{1}{4}$ oz.
Alum	$\frac{1}{4}$ oz.

The prints should be thoroughly immersed in this bath, to insure proper hardening of the film.

659. **Trays.**—It is advisable to have trays of good size, so that if you want to make large prints you will be equipped for such work. The hypo trays, especially, should be several inches larger than the prints to be finished. These trays you can readily make yourself. To do this, simply make a wooden tray and cover on the inside with oil, coach, or gossamer rubber-cloth. By folding the corners you can get a nice fit. Allow the cloth to come over the outside edges and tack with nicked carpet tacks, tacking on the outside of the tray—*never on the inside*—as the tacks when wet might rust, and the rust will cause stains when they come in contact with the print.

660. When prints are made as large as 16 x 20 inches the hypo tray should be at least 20 x 24 inches. Mark this tray "Hypo Tray," and use it for nothing else. It is a good plan to have two different size trays for developing, 11 x 14 for small and medium-size work, and 20 x 24 for the larger sizes. Mark these trays "Bromide Developing Trays." While hard rubber trays are the best to use for developing, yet one can make his own developing trays as

well as hypo trays. *Never use trays intended for developing for anything else* and when making your own trays, before tacking the cloth to the tray it is a good plan to apply a heavy glue paste to the inside of the tray, and then to lay the oil-cloth in the box and press it down evenly on the bottom and sides. Fold the corners nicely and you will have a perfectly smooth tray.

661. **Developing.**—After you have exposed a piece of paper place it in a box where it is safe from the light and in no danger of being affected by moisture or water. A drop of water coming in contact with a piece of exposed Bromide paper will leave a white spot, for the developer will not act on the spot that is wet even if you take the trouble to dry it. If development is undertaken immediately, however, there is no apparent harm although it is best to be as careful as possible. Next, prepare your developer by diluting the stock solution according to the strength of the negative you are printing from. For normal strength negatives take, concentrated stock solution 1 oz., water 6 ozs.

For weak, thin negatives use 8 ozs. of water. A diluted solution gives more contrast, while a strong solution will give softer results. Prepare only sufficient solution to fully cover the print. Seven ozs. of developer is sufficient for 16 x 20 prints.

662. Next, carefully wash your developing tray and half fill it with water; then take your exposed paper and slide it under the water, face up (you are now, of course, working in the yellow light), and allow it to remain for a few minutes, or until it has become thoroughly wet, being careful to remove all air-bells, as they will cause white spots on the print. When the print is perfectly limp and lies flat, pour off the water and flow on your developer. Always use a circular movement when applying the developer to the paper, starting at the corner nearest the left hand and allowing the solution to spread over the entire print. This must be done quickly. The image should appear slowly and should develop up strong, clear and brilliant.

663. If you notice that there are parts of the print that seem to hold back in developing, which would be the



EAST IS EAST AND WEST IS WEST

STUDY NO. II—See Page 357

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case in a contrasty negative or when there is under-exposure, rub these parts very gently with your hand, as the warmth of the hand will cause the developer to act more readily.

664. When your print is developed as far as you want it, or in other words, is done, or when the shadows are sufficiently black—and this is almost entirely governed by the exposure—pour off the developer and flow fresh water over the print. All this must be done very rapidly—quicker than it takes to tell it—as many good prints are spoiled by just a trifle over-developing, giving you a print which is too gray and dark.

665. In case of over-exposure add a few drops of a 10% solution of Bromide of Potassium directly to the developer. Be careful, however, that the Bromide does not come directly in contact with the print. Tip your tray so as to have the developer in one corner and add the Bromide; stir quickly with the hand, to thoroughly mix it with developer, and then allow it to flow back over the print.

666. After you have given the print a change of fresh water it is ready to place in the fixing-bath, which you have previously prepared according to the instructions. Slide your print into the tray, well under the surface of the bath, being careful to avoid air-bells, as these air-bells, if not removed, will cause yellow stains. If you have a number of prints slide each one under the preceding ones. In this manner you will have each and every print thoroughly covered with Hypo and you will obtain prints free from spots and stains. These should be handled over and over during the fixing, which will take about 20 minutes.

667. After they are fixed, place them in a tray of running water, being careful that the direct stream from the tap does not fall on the face of the prints, as this is liable to cause blisters and breaks in the paper. It is well to remember that a Hypo bath too strong, too cold, or too warm, is liable to cause blisters; also uneven temperature of baths and wash waters will have the same effect. A good remedy for blisters is to place the print, after it comes from the

hypo, in a strong salt bath prepared as follows:

668. Formula for Salt Bath.—

Water	3 qts.
Salt	a large handful

Dissolve thoroughly and immerse the prints in this bath for a few minutes, and then change to fresh water for final washing. A positive preventative for blisters will be found in the metabisulphite fixing bath. (See paragraph 658.)

Note: Clean dishes and clean hands are absolutely essential in producing perfect prints. The faintest trace of hyposulphite of soda or pyrogallic acid carried by the hands to the solution is fatal to good results; therefore one cannot be too careful to avoid any contamination.

669. Making Prints on Enamel Bromide.—Prints that are made on Enamel Bromide are liable to have fine black lines on them, commonly called hair-lines. These are abrasion marks and are caused by silver coming to the surface of the paper either when packing or shipping, or by something heavy being placed on it which jars the silver to the surface. These lines can be removed very easily, when the print is dry, by moistening (not wetting) a piece of absorbent cotton with wood alcohol and rubbing over the black lines.

670. Non-Poisonous Developer.—For those who desire to use a non-poisonous developer we would advise substituting Ortol, in like proportions, for Metol.

671. The following **Amidol Developer** will also produce brilliant prints:

Stock Solution

Water	12	ozs.
Sulphite of Soda, Crystals	3	ozs.
Amidol	$\frac{1}{2}$	oz.

672. For the amateur or photographer who intends making only a few prints at a time we would advise making

up only half the quantity of this stock solution. To develop use :

Stock Solution	1½ ozs.
Bromide of Potassium, 10% Sol.....	8 drops.
Water	6 ozs.

673. Washing Prints.—Prints should be thoroughly washed for at least half an hour after fixing. If this is conscientiously done there is no reason why they should not be permanent. Even though you wash your prints in running water, pick them over occasionally so as to keep them separated and make it possible for the water to flow between the prints.

674. Temperature.—Have the temperature of your baths and wash waters as near alike as possible, being guided by the temperature of the water in which you are going to wash them.

675. Vignetting.—Very pretty and soft vignettes can be produced by the following simple instructions: Cut a hole in a piece of cardboard or strawboard the shape you want the vignette to appear (pear shape is best). The cardboard should be a little larger than your enlargement. Hold the cardboard in your hand and stand to one side of, and facing, the easel, and place this cardboard between the lens and the easel to which the paper is tacked. Uncap the lens and hold the vignetter (the cardboard with the hole in it) between the lens and easel, so as to cut off or vignette away the portion that you do not want. The vignetter must be kept moving slightly back and forth between the lens and easel, and far enough from the lens to admit light only to the portions you want. Vignette and block out the light from the parts you do not desire. Continue this to and fro movement through the entire exposure, which should not be less than 20 to 30 seconds, the lens being stopped down, if necessary, to give you sufficient time to operate the vignetter.

676. To produce a soft, even, brilliant vignette requires

some little practice, but the "knack" once acquired it becomes quite easy. Should you hold the cardboard steady without moving it you would produce a sharp outline. By moving or shaking it slightly you soften the blend. It would be advisable to first practice manipulating the vignetter with the image projected on the screen before attaching the sensitive paper thereto. This will give you an idea of what is required before making the exposure.

677. **Dodging.**—If you have some dense highlights in the negative that require printing more than other parts, and this oftentimes happens on faces and white drapery in which no detail appears, you can readily overcome this by extra printing—in other words, extra exposure on these parts. To do this, cut a 2 to 3 inch round hole in a cardboard, and holding this in front of the lens you can direct the concentrated light coming through this opening to any part you desire, thus enabling you to produce an even print. The nearer you hold it to the lens the larger the surface you expose, and *vice versa*.

678. By keeping the spot of light moving almost any amount of additional detail may be obtained locally. Remember, however, that this cardboard must be large enough to prevent the light striking the paper on any part other than where the hole is cut in the cardboard. Occasionally, in full-length portraits a hand requires less exposure than the rest of the picture. In this case a small piece of cardboard, cut to the proper shape and stuck on the end of a piece of wire or knitting-needle, can be used to screen that part of the image. Or, by sticking a round piece of cardboard (about the size of a half dollar) to the end of a glass rod, and adjusting this before the lens, over the portions to be held back, you can even the tone nicely. The glass rod, being transparent, will not affect any other portions of the print.

679. The paper, you will note, lends itself to innumerable dodges which may be practiced in a similar manner, the operator being able to see just what he is doing from his position near the easel.

680. **Correcting Distortion.**—The application of the following method for correction of views already distorted will be found of considerable interest to the serious worker: There are few photographers who have not, at some time or other, obtained negatives of street scenes with the houses looking to each other for support, or architectural studies with columns out of plumb, caused by the absence or misuse of the swing-back or rising front.

681. You may have an architectural negative or view of a building to enlarge, the lines of which, however, are faulty. The building appears, for instance, broader at the bottom than at the top. To obtain a print with the lines corrected, provide a white card large enough to cover the size enlargement you expect to make. Rule this card-board for different size openings. If your easel will receive a 20 x 24 card, rule one opening 16 x 20, another 14 x 17, another 11 x 14, etc. Tack this card to the easel; place the negative in the enlarging camera so the lines to be corrected are in a perpendicular position, and obtain a focus. By tipping the enlarging easel or board forward or backward, you will find it possible to correct these lines. Tip the board or easel until the perpendicular lines coincide with the perpendicular lines on the board or easel.

682. You must be careful, however, when you are placing your negative in the holder for enlarging, that you place it in upside down so that the image will appear right end up on the enlarging board. By tipping the top of the easel toward the camera it brings the top considerably nearer to the negative than the bottom, and it acts like a swing-back on the camera. You will, however, notice that either the top or bottom of the picture will be very badly out of focus. To overcome this out-of-focus effect you must slightly divide the focus and use an extremely small stop and, of course, give a correspondingly longer exposure.

683. **Using Silk Bolting-Cloth.**—When using Royal Bromide paper beautiful effects of softness and breadth can be obtained by enlarging through a silk bolting-cloth screen. This screen will break up the intensity of the blacks, and

add to the breadth of the half-tones, and when prints so made are given a sepia tone they have the appearance of rare old etchings. When enlarging from a portrait it does away almost entirely with retouching. The screen may be used in direct contact with the paper, in which case the enlargement has the effect of being made on fine meshed canvas. Greater diffusion of light, however, may be obtained by placing the screen at a distance of one-fourth to one inch from the paper. The further the screen is removed from the paper the greater the diffusion of light. When using the screen you must increase the length of exposure about one-third.

684. Use the fine mesh bolting-cloth for large prints on smooth paper; the medium or coarse mesh on rough paper; while for small prints use the fine mesh. You will find, by providing yourself with a fine mesh screen, and then producing the different effects by either printing in close contact or moving the screen some distance from the paper, you can produce the different effects almost as easily as if you had a number of screens of different mesh.

685. Silk bolting-cloth, especially adapted for enlarging, can be purchased from the Eastman Kodak Company, Rochester, N. Y. It is supplied in rolls, and is securely packed in pasteboard tubes to avoid creasing. It is put up in three grades—fine mesh, medium mesh and coarse mesh. It can be purchased by the yard or in 18 x 20 inch squares. A good plan is to tack this cloth securely on a stretcher so that it will be perfectly smooth, and before using it should always be carefully dusted with a soft brush.

Don'ts.

686. Don't use an old hypo bath for fixing.

687. Don't place the prints between blotters to dry.

688. Don't use the developing-dish for fixing.

689. Don't let a jet of water run on the paper while washing; it will cause blisters.

690. Don't fail to keep the solution in motion while developing.

691. Don't rock the tray in one direction only; if you do you will produce streaky prints.

692. Don't expect to have permanent prints unless they are thoroughly fixed and washed.

693. Don't expect that the light reflected from a red brick wall will be sufficient for enlarging. Unless your enlarging window has an unbroken horizon you must use a reflector.

694. Don't use old developer on large prints for the sake of economy; use it fresh every time.

CHAPTER XXXIII.

Sepia and Green Toned Bromide Prints.

Part I.

Introduction.

695. **Cold Hypo Toning Bath.**—The cold hypo toning bath is especially adapted for the Eastman Royal Bromide, Enamel, and Matte-Enameled Bromide papers. By preparing this bath according to instructions beautiful, rich brown and sepia tones can be easily obtained.

Hyposulphite of Soda	10 ozs.
Ground Alum	2 ozs.
Boiling Water	1 gal.

First, dissolve the hypo in the hot water. For this, only enough water need be heated to dissolve the hypo. Then add the alum slowly, stirring vigorously. When all is dissolved the solution should appear milk white. The older the solution, the better it works.

696. **To Tone.**—After the prints are developed and fixed—and we would say here that the prints *must be* thoroughly fixed before toning—wash in three or four changes of water and then place in the cold toning bath, sliding the prints, face side down, under the solution, thus avoiding air-bells. When toning several prints slide them one by one underneath the first print immersed. The print, or prints, should be handled over occasionally during the first four or five hours, and may then be left in the bath over night, or until the desired tone is acquired.

697. After toning, wash thoroughly for two hours,

when they are ready to dry. They should always be toned face down. This solution can be used repeatedly by adding a fresh bath at frequent intervals. A number of prints can be toned at the same time. Spots or unevenness of tone will disappear if the print is left in a bath and frequently moved. The toning takes from fifteen to twenty hours. By heating the bath the toning can be hastened. Care should be taken, however, to keep the prints moving in the heated bath, to prevent the formation of air-bells.

698. **A yellow tone instead of a sepia** is caused by the water not being sufficiently hot when the bath was first made up. *It is absolutely necessary to have it hot, because the hot water frees the sulphur from the hypo and produces sulphurization.*

699. **A Rapid Sepia Toning Bath.**—The following formula gives a much more rapid toning bath; tones can be obtained with it in about 20 minutes. You must bear in mind, however, that a fresh bath tends to reduce the print and also gives a more yellow tone. Old baths give dark and colder (almost purple) tones. All prints dry with a slightly colder tone. No matter how long such a bath has been used it should never be thrown away, but some of it, at any rate, mixed with the fresh bath, so as to give age to the latter.

Hypo	3½ ozs.
Water	20 ozs.
Powdered Alum	130 grs.

To this add 30 grains of Nitrate of Silver.

700. Dissolve the Nitrate of Silver in a little water before adding. Heat this bath to 120° Fahr. and allow it to cool. Prints should receive two or three changes of water after fixing, and then place into this toning bath. While the prints are in the toning bath again heat the bath to 120° Fahr.

701. The first formula, although it is much slower, gives the better results, and we, therefore, recommend its use.

Part II.

Rapid Sepia Tones by the Bleaching and Re-Developing Process.

702. By this process prints may be given a rich sepia tone in from two to five minutes. Bromide prints made for sepia tones by this process should be developed a blue black. They must be thoroughly washed after fixing, in order to eliminate all Hypo, and can be re-developed either after drying or at once after washing.

703. **Permanency.**—The re-developing process gives a result which is chemically identical with that obtained by the hypo alum toning, and the print suffers no change in detail or gradation.

704. **Uniformity.**—Following the directions given herein insures absolute uniformity, and a print can be toned sepia in less than two minutes.

705. **Directions.**—Make up the stock solution as follows:

706. No 1. Bleaching Solution.—

Ferricyanide of Potassium	5 ozs.
Bromide of Potassium.....	5 ozs.
Water	120 ozs.

Place this solution in a bottle and label it Bleaching Solution.

707. No. 2. Re-Developing Solution.—

Sulphide (not sulphite) of Soda	5 ozs.
Water	60 ozs.

Place this solution in a bottle and label it Re-developing Solution.

708. Prepare the bleaching bath for use as follows:

Stock Solution No. 1 (Bleaching Solution).....	4 ozs.
Water	4 ozs.
Aqua Ammonia	4 drops

709. Preparing re-developer for use:

Stock Solution No. 2 (Re-developing Solution)..1 oz.

Water8 ozs.

710. **Manipulation.**—The bleaching bath should be prepared in one tray and the re-developing bath in another. These trays should not be used for any other purpose, and each tray should be labeled. Immerse the print in the bleaching bath, allowing it to remain until only faint traces of the half-tones are visible and the black of the shadows has disappeared entirely. The image at this stage will resemble that of an undeveloped platinum print. This operation should not take longer than one minute. When the print reaches this stage rinse thoroughly in plain cold water; then place in your second tray of re-developing solution, allowing it to remain in this bath until the original detail returns. This will require from 15 to 25 seconds. When all the detail has returned, rinse under the tap for a moment, then place in running water for half an hour. After the prints are thoroughly washed, remove the surplus water by placing them between blotters; then hang up to dry.

711. **Blisters.**—Blisters are apt to occur in re-development, and usually result from the black and white print not being fixed in a fresh hypo bath. Or, if an acid hypo bath was used, glacial acetic acid may have been employed instead of *commercial acetic acid*. The blistering can usually be avoided by adding 1 oz. of formalin to each 30 ozs. of bleaching solution. A positive preventative will be found by immersing prints, after re-developing, in an acid hardening bath (omitting the hypo), in proportion 1 oz. of hardener to 16 ozs. of water. This will overcome all tendency to blister. (See page 208.)

712. **Note.**—For those who do not wish to prepare their own sepia toning chemicals, they can procure ready prepared Royal Re-developer from any agency of the Eastman Kodak Company. One package, sufficient for re-developing two hundred 8 x 10 prints, or their equivalent, costs 75 cents. When ordering these chemicals, simply ask for a package of Royal Re-developer.

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Part III.

Special Tones on Bromide Paper.

713. Bright Blue Tones.—A bright blue tone can be obtained with the following bath:

Formula.

Iron Alum	10 grs.
Potassium Ferricyanide	4 grs.
Hydrochloric Acid	10 minims
Water	10 ozs.

After developing and fixing, immerse the prints in this toning bath until the desired color is obtained and then wash well. If the prints are subsequently fixed (returned to the Hypo Bath) a more transparent blue is obtained.

714. Greenish Blue and Green Tones.—By treating the blue toned print with the following bath for a short time, greenish-blue or green tones are obtained:

Sodium Sulphite	1 gr.
Hydrochloric Acid	1 drop
Water	20 ozs.

Care must be taken not to leave the print in this bath too long or it will turn black.

715. Deep Blue Tones.—

Iron Alum	12½ grs.
Potassium Ferricyanide.	10 grs.
Oxalic Acid—Sat. Sol.	30 minims
Ammonium Alum—Sat. Sol.....	50 minims
Hydrochloric Acid	25 minims
Water	10 ozs.

Place the print in this bath until the desired tone is reached and then wash carefully.

716. **Green Tones.**—

Vanadium Chloride	2 grs.
Ferric Chloride	1 gr.
Ferric Oxalate	1 gr.
Potassium Ferricyanide	2 grs.
Oxalic Acid—Sat. Sol.	2 drs.
Water	4 ozs.

Mix the iron salts with the Ferricyanide and acid in water. Dissolve the Vanadium with 2 or 3 drops of Hydrochloric Acid and boiling water and add to the other salts. Immerse the print in this bath until the high-lights are a slate blue and then wash until green.

717. None of these blue or green tones can be considered absolutely permanent, although they will stand for quite a long time. The least permanent tones are those obtained in baths containing Vanadium.

718. **What Papers to Use.**—By exercising a little judgment in selecting the paper, almost any class of negative can be improved and the desired results obtained. From the large variety of bromide papers you have the following from which to make a selection:

719. **Nepera Bromide** is made in three grades and is manufactured by the Nepera Division of the Eastman Kodak Company. It is considerably cheaper than the regular Eastman papers. **Platinoid** is a matte surface paper giving platinum effects. **Rough Surface** is a heavy paper generally preferred for crayon work. **Glossy**, or **Enamel**, is for glossy surface prints and can be burnished or squeegeed.

720. **The Eastman Standard Bromide** paper has a natural surface and is adapted for all kinds of enlargements, such as copies on which pastel and crayon finishing is to be done. It is made in three grades; these we have already described to you.

721. All papers are made in two grades, hard and soft. **Hard** is for daylight enlargements from negatives of good printing quality or from enlargements on thin negatives by artificial light. **Soft** is especially adapted for artificial light and for enlarging from contrasty negatives. For gen-

eral work we recommend **Nepera Platinoid Bromide**, as this paper has a great deal of latitude and almost any effect desired can be obtained. It is made in two grades, medium and rough. The **rough** is better where the prints are to be worked with crayon, as the rough surface will take the crayon nicely. The **medium** is to be used when the print is from a good negative and is only to be spotted—touched up—with India-ink the same as a platino print.

722. **Royal Bromide.**—Royal Bromide paper is a specially made, coarse grain, cream tinted surface, and is intended for broad effects. This paper gives best results when toned to a sepia color, and is not usually used for anything smaller than 8 x 10 prints.

CHAPTER XXXIV.

General Finishing of Enlargements.

723. **Drying Bromide Prints.**—If the prints are to be trimmed, you can take them from the water and hang them up by attaching spring clothes-pins to a line which you have stretched from one corner of the room to the other. Fasten these clothes-pins to the top of the prints and allow them to drain until they are dry, after which you can trim them.

724. **Flattening Unmounted Prints.**—After drying, prints may be straightened by the scraping action of a sharp edged ruler applied to the back. The corner of the print behind the ruler must be lifted as the ruler is passed along.

725. **Preventing Unmounted Prints from Curling.**—Soak your prints in the following solution:

Water	25 ozs.
Glycerine	5 ozs.

and then hang up to dry. This will prevent their curling and the prints may be mounted at the corners only—loose mounting as it is called.

726. **Mounting.**—It is advisable to mount Bromide prints solid and they should be mounted while wet. To do this, place them on your mounting-board or clean glass, face down, squeegee the water out of them and spread the paste on in the usual manner. This paste should spread easily and have good sticking qualities, as the paper is considerably thicker than the ordinary printing papers; therefore, if your paste is poor the prints will peel from the mount. Cover the prints with a clean blotter and roll into contact with a print roller.

727. Mounting on Cloth.—Enlargements are often mounted on cloth-covered stretchers. These stretchers are similar to the kind artists use for stretching canvas. Cover with white cotton cloth. Put the cloth on dry, stretching it tight and tacking along the edges. Lay the wet print face down on your mounting board or glass and squeegee off the surplus water; then apply the paste. Give the cloth on the stretcher a coat of paste and lay the print on the stretcher; then turn the stretcher and print over and lay face down on a clean mounting board or glass, and rub into contact with a soft cloth. Next turn the stretcher over and cover with a clean piece of cotton cloth, rubbing into contact with the hand or soft cloth. Rub under edges of frame with a paper or palette knife and remove what paste may have come through the back of the cloth under the frame. Unless you do this the inside edge of the stretcher will show through. When dry the prints will be stretched smooth and tight.

728. Ferrotyping Bromide Prints.—To obtain a gloss far exceeding that obtained by any burnisher we would recommend the ferrotype process, and the resulting prints will be equal to the results produced by the troublesome glacé process.

729. Cleaning Ferrotypes Plates.—It is absolutely necessary that the ferrotype plate be thoroughly cleansed with hot water each time it has been used. Polish with a soft cloth until plate is absolutely free from dirt or specks of any description. Next swab with a tuft of soft cloth or cotton batting wet in a solution composed of one ounce of benzine to 10 grains of paraffine. Rub dry with a clean cloth and polish with a chamois skin or very soft cloth. Use a soft camel's-hair brush to remove particles of dust or lint from the plate.

730. Placing Print on Ferrotype Plate.—Lay the wet print face down on the ferrotype plate. It must be in perfect contact to produce an even, uniform glossy surface. By placing your ferrotype plate and enlargement into the tray of water and then placing the print on the ferrotype

plate, while both are underneath the water, there will be less danger of air-bells gathering and better contact is secured. When the print is in position on the ferrotype plate, remove both from the water, laying the plate on a perfectly smooth surface. With a squeegee or a rubber roller, expel any air-bells that might have gathered, at the same time removing the excess water. Light rolling is better than using a heavy pressure as the latter is liable to make the prints stick in spots. When the surface (in this case the back of print) is dry and while still on the plate, apply with your brush a thin solution of white glue. When bone-dry strip the print from the plate and lay the print on the mount, the face of which must previously have been well moistened with a wet sponge, and rub or roll down with a dry blotter. Then dry, face up, free from dust.

731. Coating Mounted Prints so as to Produce a Fine Gloss.—A beautiful gloss may be given Enameled Bromide prints by coating the unmounted print with a solution of gum arabic:

Gum Arabic	1 oz.
Water	4 ozs.

When dissolved filter through chamois skin each time before using. Apply smoothly with a camel's-hair brush. If too thick to spread readily and smoothly, thin by adding water until you produce the proper consistency.

732. Spotting, or Touching Up.—Spotting should be done before squeegeeing, and the color used in spotting should be mixed with glue solution to which has been added a little alum. This will prevent the color from washing off. This spotting color, however, should be used warm. Remember that the ferrotype plates must have the highest gloss obtainable. The glue for mounting must be white and clean. Unless this kind of glue can be obtained it is advisable to use gelatine, which really is purer and better.

733. Formula for Glue.—

Best white glue or gelatine	3 ozs.
Water	18 ozs.

You will find this glue will keep almost indefinitely if you will add a little Carbolic Acid or Thymol. It must be heated for use, however. Soak the glue or gelatine in cold water for one-half hour, then heat to 110° Fahr. until dissolved. Strain through fine linen, when it is ready for use. Apply thinly and evenly to the print.

734. **Caution.**—The print must be bone dry before stripping or it will not strip. The mount must be evenly moistened on the face with a wet sponge. If your mounts have lithographed India-tinted centers they should be rubbed with powdered pumice stone, to produce a surface that will cause the glue to stick, and they must be carefully dusted off before moistening.

735. The ferrotype plates must be cleaned with hot water each time before using.

736. Ferrotype plates can be purchased in two different sizes, 10 x 14 and 18 x 24, and in two different weights, light and heavy.

CHAPTER XXXV.

Difficulties—Bromide Enlarging.

737. Mealy, Mottled Prints.—Over-exposure and short development.

738. White Spots.—White spots are generally caused by air-bells gathering on the print when first placed in the water and allowed to remain while the developer is poured over the print. Wherever an air-bell appears it prevents the developer from acting on the sensitive emulsion of the paper and consequently it leaves a white spot. Particles of dirt in the developer or water settling on the print will cause white spots. Drops or splashes of water striking the print before being immersed in the water and before developing will cause white spots.

739. Small Black or Brown Spots.—Generally caused by some foreign metallic matter, such as iron rust, in the water or developer.

740. Print Develops Weak in Shadows with Gray High-Lights.—This is an almost certain sign that you did not use enough Bromide in your developer.

741. Prints Gray in the High-lights, Having Mottled Shadows.—Caused by over-exposing and then not carrying the print far enough in the developing. If you did carry the print far enough the print would be too black.

742. Prints Weak and too Light.—A certain sign that you under-exposed or possibly under-developed.

743. Prints Strong in the Center but Weak at the Edges, Appearing Almost Like a Vignette.—This shows that your illumination on the negative was not evenly distributed.

744. Prints Very Light and Yellow.—This is caused by under-exposure and prolonged development.

745. Prints with large Yellow Stains of Different Sizes.—This is almost a certain sign that the print was not thoroughly immersed in the Fixing Bath. If any air-bells are allowed to gather on the print when in the Hypo they prevent the Hypo from attacking the film and this will result in yellow spots.

746. Streaky Prints.—Caused by uneven development, or by rocking the tray in one direction.

747. **Dark Prints.**—Caused by over-printing.

748. **Blisters.**—Caused by either too warm a developer, too strong Hypo, or uneven temperatures of baths and wash waters. Give your prints a strong salt bath immediately after fixing. This will generally overcome this difficulty.

749. **Prints Developing Gray Even After Sufficient Bromide has been Added.**—This is a sure sign that your paper has become fogged either by your dark-room light not being perfectly safe or because the package was opened in daylight.

750. **Enlargement Sharp in the Center but Out of Focus at the Edges.**—Evidently your lens is not large enough to cover the plates to be enlarged and does not cut absolutely sharp to the edges unless a small stop is used. Use a smaller stop or diaphragm and the entire image will be perfectly sharp, provided the negative is sharp.

751. **Green Tones.**—Green tones are caused by over-exposure or by using too much Bromide. Discard this bath and add your Bromide to the new bath cautiously. Use small pieces of paper to test it and add only enough Bromide to cause the whites to develop clear without showing any green.

752. **Flat Prints.**—Flat prints will occur when you use too soft a paper on a flat or *soft* negative. Making your enlargement from such a negative by daylight and stopping down the lens sufficiently would produce contrast.

753. **Contrasty Prints.**—Caused by printing from a strong negative and using hard paper, or printing from a strong negative by artificial light. Give longer exposure and dodge while printing by covering up the portions that print rapidly, and allowing the extra exposure only on the parts which are strong.

754. **Sharp Vignettes.**—Caused by not keeping the vignetter in motion. Work your vignetter to and fro, up and down, back and forth between the lens and enlarging easel.

755. **Prints Refusing to Tone Sepia in the Hypo-Alum Bath.**—If this bath has been prepared properly you should have no trouble. This is extremely slow in toning, but you will find it will work better after a number of prints have been toned in the bath. A good plan is to cut up an old print and put it into the fresh bath when it is first made up. This will help to ripen the bath, give it age, and it will tone much more readily.

756. **Difficulty in Judging Which is the Sensitized Side of the Paper.**—This difficulty you will readily overcome after a little practice. You will always be able to distinguish the face of the paper by its curling in, the convex side being always the back.

757. **Enlargement Reversed from the Original Negative.**—Caused by placing the negative in the holder the wrong way. Always face the film side of negative toward the lens.

758. **Image Appearing Upside Down on the Enlarging Easel.**—This is because you placed the negative right side up in your holder in the enlarging-camera. Place it into the holder upside down and it will appear right side up in your easel.

759. **Hair Lines, Like Fine Pencil Marks, on Enamel Bromide Paper.**—These are abrasion marks and the lines generally appear rather prominently after development. If allowed to remain they would spoil an otherwise good picture. They are, however, easily removed, but from the dry print only, by gently rubbing with a tuft of cotton moistened with wood alcohol.

760. **Small White Spots and Streaks on Matte-Enamel and Platinoid Papers.**—Caused by the developer not acting evenly when first flowed over the print. To overcome this, before pouring the developer over the print, take a camel's-hair brush, or a piece of cotton and brush over the entire print while it is immersed in the water.

761. **Not Fixing Properly.**—You can tell when the prints are fixed by looking through them or upon the surface in a good strong light. The unfixed portions will be of a greenish-yellow tint. When thoroughly fixed they are clear and even throughout.

CHAPTER XXXVI.

Bromide Enlarging Pointers.

762. Prints Appear Dark in Dark-Room.—Prints will appear darker in the yellow light of the dark-room than in daylight when finished. Bear this in mind, and do not stop development too soon.

763. Stopping Action of Developer.—When developing with Metol-Hydroquinon developer, the development can be stopped instantly by immersing the print in a salt bath made up as follows: One ounce of salt to 10 ounces of water.

764. Developing Light.—Prints must never be exposed to any light except that of the dark-room—the yellow light—until they are fixed. All the work of Bromide enlarging can be done in a strong yellow light.

765. Rusty, Green Tones.—Over-exposure and weak developer will produce rusty, green tones.

766. Drying Bromide.—Never dry bromide prints between blotting papers.

767. Washing.—Prints should be thoroughly washed in 30 minutes, using running water or giving the prints frequent changes.

768. Fixing and Washing.—It is better to thoroughly fix and wash little than to prolong the washing and not fix properly.

769. Life of Developer.—The same developer can be used for a number of prints in succession, but should be thrown away when it becomes slow in action. Unless you do this the resulting tones on the prints will be poor.

770. Cracked Trays.—Cracked, or rough surfaced developing trays will cause marks and lines on the prints.

771. **Prints Sticking Together.**—Prints should never be allowed to stick together in the fixing bath, as that is apt to cause stains.

772. **Stains from Old Developer.**—Developer which is old or used too often will cause stains.

773. **Cleanliness.**—By observing absolute cleanliness throughout the entire manipulation you will avoid stains.

774. **Master One Brand of Paper.**—Use one brand of paper; stick to it; learn to understand it.

775. **Trial Exposures.**—Making trial exposures on slips of paper will pay you in the long run.

776. **Agitate Developer.**—Keep the developer agitated by rocking the developing tray, but never rock in one direction only.

777. **Finger Marks.**—Never touch the sensitive surface of the paper; fingers are apt to be moist or dirty and these will cause stains and spots.

778. **White Light.**—Never expose the prints to any light except that of the dark-room until they are thoroughly fixed.

779. **Stains on Edges of Print.**—Stains on the edges of prints are sometimes due to old paper, but more often they are caused by paper coming in contact with the edge of the hypo tray before it is fixed.

780. **Blisters.**—Uneven temperature of solutions and wash waters or a stream of water flowing directly on the surface of the print is apt to cause blisters.

781. **Keep Prints Immersed.**—Prints should always be fixed face downward, must be thoroughly immersed, and not allowed to float on top of the hypo, as discoloration may occur. By being careful about this you will be insured of complete fixation.

782. **Temperature.**—The temperature of all solutions should be from 60° to 65° Fahr.

783. **Mixing Solutions.**—During cold weather use warm water for making up the solutions so as to have them at the proper temperature.

784. **Size of Trays.**—Remember that all dishes should be a trifle larger than the prints.

785. **Quantity of Developer to Use.**—Do not try to be economical with the developer, but use sufficient to thoroughly cover the print. In this way you will avoid markings and stains.

786. **Trays.**—Never use the same dish for developing and fixing.

787. **Grade of Paper to Use.**—Never use rough paper for a small enlargement.

788. **Hypo in Developer.**—Remember that a trace of hypo in the developing dish will surely cause stains.

789. **Clean Fixing Bath.**—In order to produce clean prints it is necessary to have a clean fixing bath.

790. **Finest Results.**—Correct exposure and full development in diluted normal developer gives the finest results.

791. **Sensitive Side of Paper.**—Remember the sensitive side of Bromide paper is the side that curls inward. If in doubt, nick the corner of the sheet with your teeth; the film side will stick.

792. **Cutting Paper.**—If you desire to cut the paper you must do so with a pair of shears, or a sharp knife, and never fold or tear it, as this leads to markings.

793. **Care of Unused Paper.**—After removing the sheet of paper from the package, always replace the remainder before doing anything else. Unless you do this, sooner or later you will fog some of the paper.

794. **Obtaining Vigorous Prints.**—Vigorous images with good, rich blacks are produced by giving short but sufficient exposure and developing with strong but slightly restrained developer.

795. **Quick Development.**—Prolonged development will cause yellow prints. The exposure should be correct so as to allow of quick development.

796. **Thorough Washing.**—Washing in running water is not so thorough as changing the prints from one tray to

another, allowing them to soak at least ten minutes in each change of water; a half dozen changes will then be sufficient.

797. **Removing Stains from Prints.**—Developer and other stains can be removed by gently rubbing the surface of the print with

Thio-carbamide	5	grs.
Nitric Acid—C. P.	5	mms.
Methylated spirits (Wood Alcohol).....	$\frac{1}{2}$	oz.
Water	$\frac{1}{2}$	oz.

Always plunge the prints under water after each rubbing.

CHAPTER XXXVII.

Negative Enlarging.

Introduction.

798. There are times when one is well equipped for making good small negatives, but, has not the necessary apparatus for making large negatives. Professionals, very frequently, are handicapped for space sufficient to operate a large camera, and, in consequence, can only make small size negatives, notwithstanding the fact that they frequently have calls for larger prints from the same negative.

799. The amateur, too, very frequently has small negatives which he would like very much better if they were double or triple the size. A Bromide enlargement from the smaller negative would, in some cases, answer for a single print, or even two or three prints; but there are times when the prints are desired made on platinum, or some other printing-out paper. It is then absolutely necessary to make contact prints, and, therefore, they must be made from an enlarged negative. To meet these requirements this instruction is prepared.

800. **Methods.**—Two methods for making enlarged negatives will be described—one worked in the open light, using a large camera containing a long bellows; the other in the regular dark-room, or a small room made absolutely dark, employing the same method as for making Bromide enlargements, the dark-room serving as a large camera. The first method is employed in studios, and where large cameras are used, therefore, it will be described first.

801. **The Transparency.**—No matter which method is

employed, for all negative enlargements a positive transparency must first be made; then from this transparency make the negative. This can be done in two ways: Making the transparency by contact, then making the enlarged negative from the small transparency; or, making an enlarged transparency from the small negative, then making the large negative, by contact, from the enlarged transparency.

802. The latter method has advantages and may give better results, yet it is more expensive, as it requires two large plates. The former method requires only one large plate and one small one the size of the original. Therefore, the first method is generally used, and is recommended for your first experiments at least.

803. **Kind of Plates to Use.**—For making the transparency the best results are produced by the use of a special transparency plate, or an ordinary slow plate. Ordinary rapid plates can be used, but they will require more exactness in the exposure. For making the enlarged negative from the transparency, it is not as necessary to have a slow plate as it is in making the transparency, for upon the quality of the transparency depends the result of the enlarged negative.

804. **Quality of the Emulsion.**—Regular transparency plates are of a finer emulsion, and there is less danger of grain showing in the enlargement. The grain of an ordinary plate, when enlarged, is apt to make the enlarged negative appear coarse; the resulting print, therefore, will likely have the appearance of being made from a copy. Even slow plates possess some grain, and if an average rapid plate is used for making the intermediate contact transparency, the grain of the original negative is reproduced in the transparency, and in turn, the grain of the transparency is reproduced in the enlarged negative.

805. **Advantage of Fine Grain Emulsion.**—The advantage of using a close-grain plate for the intermediate contact transparency for enlarging will be readily seen. With a little care in the exposure, good enlarged negatives can be made with the ordinary dry plate, and where Platinum



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paper is used for the printing surface, the grain of the negative does not show to any great extent.

806. Making the Transparency by Contact.—The transparency must be made in a regular dark-room, or in an ordinary room that can be made perfectly light-tight. Before entering the dark-room, however, clean the glass side of the plate of your negative with a soft cloth, and dust the film with a camel's-hair brush, removing all particles of dust. In the dark-room, under the light of your ruby-lamp, place this negative in the ordinary printing-frame. Then, take a dry plate from the plate-box and place it on the negative, film to film; next, place a sheet of black paper over the back of the unexposed plate, and clamp the back of the frame in firmly. Be sure that the springs are good stiff ones, so that the plate and negative are in perfect contact. To avoid the clear margin on the edge of the plate, caused by the rabbit in the printing-frame, use a frame one size larger than the negative. Use a thick glass that will fit the large frame, and support the negative. Be sure that the glass is thoroughly clean and free from bubbles or scratches.

807. Plates to Use for Making the Transparency.—Special transparency plates are the best, but any ordinary slow plate will do. Rapid plates may be used, but they give less latitude in the exposure. Therefore, slow plates are recommended.

808. Exposure for Transparency.—The necessary exposure will depend upon the speed of the plate, the strength of the light, and also the density of the negative. The exposure should be made by artificial light. A kerosene lamp, gas, or electric light, even a lighted match, are better than daylight. In fact it is almost impossible to make the exposure quick enough by even subdued daylight.

809. Using Ordinary Rapid Dry Plates.—Hold the frame, containing the negative, about three feet from the light. If a 16-candle power electric bulb is used, a quick turning on and off of the light will give sufficient exposure. Two seconds exposure with a lighted match should be

sufficient for an ordinary negative. The exact time can be determined after one or two trials. The better the transparency, of course, the better will be the large negative. Avoid over-exposure which causes fog. There is less danger of a fog with slow plates than with the regular plates, although when slow plates are not obtainable ordinary fast plates may be used, but more care must be given to the exposure. It is advisable, when rapid plates are employed, to hold the negative farther from the light, to avoid over-timing. The printing-frame should never be held less than three feet from the light, except when the exposure is made with a lighted match, in which case two feet from the light will be sufficient.

810. **Developing the Transparency.**—When making transparencies from flat negatives, the contrasts can be increased by aiming at correct exposure (never *over-expose*) and developing strong. On the other hand, if the original negative is hard, give full time and develop normally to produce softness. Both the transparency and the enlarged plate may be developed in the ordinary way, using the regular *Universal Developing Formula* given in Volume II, but the transparency must be made stronger than for lantern-slide work, or regular direct exposures. Ordinary transparencies used for lantern projection, etc., must, of necessity, be very thin and full, with clear transparent shadows. Such a plate, if a negative were reproduced from it, would give flat, washy results, with no detail in the shadows. Therefore, when making transparencies for enlarging purposes, expose slightly longer than for lantern-slides, and develop to a good strength, using a little Bromide if you find that snap and contrast is needed. Unless the transparency has good strength the reproduction will be very flat and weak.

CHAPTER XXXVIII.

Negative Enlarging With Large Camera.

811. When the large camera is used for negative enlarging, it is best to make a contact transparency from the small negative, and then enlarge the transparency. Any size enlarged negative may then be made, limited only by the size of the camera.

812. Having made the transparency, using for example, a 5 x 7 plate, you will next provide an 8 x 10 sheet of ground-glass, or, if you have no ground-glass, flow a sheet of plain glass with *ground-glass substitute*. When it becomes set and dry, which requires only a few minutes, place the glass in an 8 x 10 printing-frame, fastening it with one tack at each end. In case neither ground-glass nor substitute can be obtained, a very fine quality of tissue paper will answer, pasted over the outside of the printing frame. Place the transparency in a 5 x 7 frame, film side out, holding the transparency in the frame with thumb-tacks.

813. Having secured the negative in the printing-frame, place this small frame inside of the 8 x 10 frame, with the film side out. This will give a space equal to the thickness of the frame between the transparency and the ground-glass (or tissue paper), which is necessary, as with this space, between the two, the ground-glass is thrown out of focus when the transparency is sharp. The ground-glass, or tissue, serves as a diffusing screen and equalizes the light on the transparency. To place the negative too close to the ground-glass, would bring it in focus with the transparency, and give a coarse grain to the enlargement. This is avoided by the thickness of the printing-frame providing a sufficient distance between the two to overcome this grain.

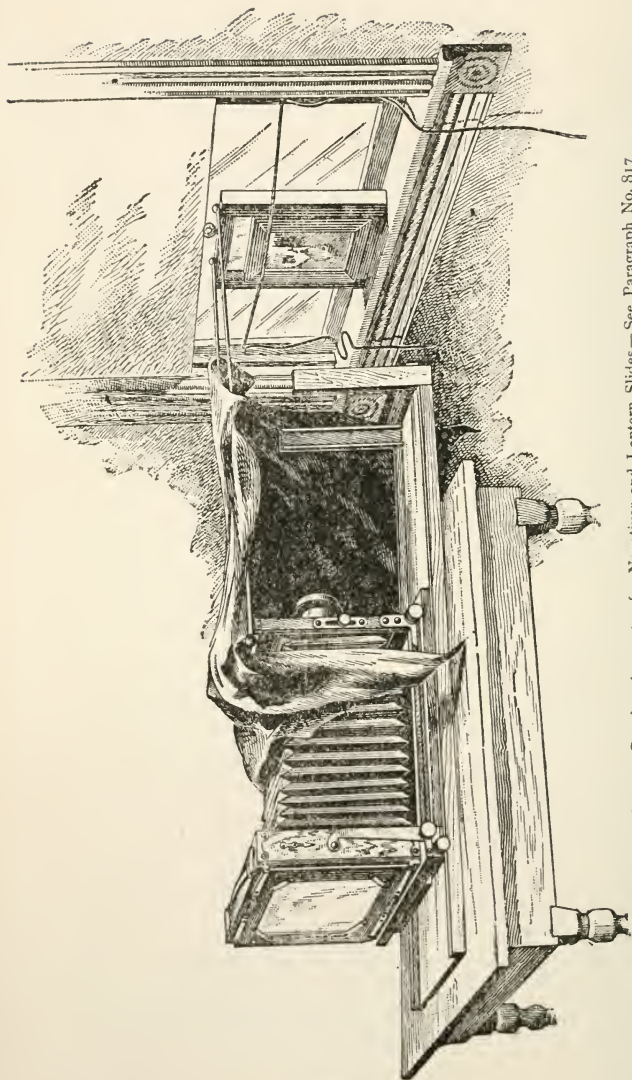


Illustration No. 20—Copying Apparatus for Negatives and Lantern Slides— See Paragraph No. 817

814. Having prepared your two printing-frames, place them in a window with an unobstructed light—a north window preferred. Let the edge of the 8 x 10 frame rest on the window sash, and hold the frames close to the window glass by means of a strong cord stretched across the window, on a line with the upper edge of the smaller printing-frame. The transparency is then ready for enlarging. For negative enlargements not exceeding 8 x 10 inches the Lantern-slide copying board may be used. (See Illustration No. 20.)

815. **Lens to Use in Enlarging.**—Any lens, other than a single lens, will do. It is preferable not to use a lens larger than the one employed in making the negative; if a larger size is used you will require longer bellows. A smaller size than that employed in making the original negative cannot be used, as it will not cover the plate sharp to the edge; but with a lens the same size, you can enlarge to any size you desire.

816. **Arranging the Camera.**—Place the large camera on a table (unless you have a stand for it) and on a level with the transparency to be copied. See that the transparency is perfectly perpendicular, and the camera on an exact line, and level with it. The size of the picture depends upon the distance the lens is from the transparency, also on the distance between the rear of the lens and the ground-glass.

817. **Obtaining the Focus.**—Place the camera, with the front of the lens within two feet of the transparency, and rack out the bellows until a sharp focus of the image on the ground-glass is secured. If the image is not large enough, push the camera closer to the transparency, and rack out the bellows further, until the correct size registers on the ground-glass. When this is obtained all light between the lens and negative from every side must be excluded. First draw the shades of the window down to the transparency; then extend two wooden strips from the camera to the top of the 8 x 10 printing-frame, and cover this frame with the focusing, or any other black cloth. This will ex-

clude the light sufficiently for the purpose intended, and the principal light will come through the transparency, thus supplying the necessary illumination for the successful copying of the transparency. (See Illustration No. 20.)

818. **Stops to Use.**—It is always advisable in negative enlarging, to use a stop at least one size smaller than is required to give a good, sharp focus. The stopping accentuates the contrast and gives a more snappy negative. When a transparency is a little flat, having been made from a negative that was a trifle flat, the result can be very much improved by stopping down, thereby accentuating the contrast.

819. On the other hand, with a contrasty transparency, where it is not desired to increase the contrast, use a larger stop. Always focus first without a stop and get as sharp a focus as possible, and then, use what ever stop is necessary to give you the desired result, judging entirely by the appearance of the image upon the ground-glass.

CHAPTER XXXIX.

Negative Enlarging With a Bromide Enlarging Apparatus.

820. **Preparing the Apparatus for Daylight Work.**—The drawing of the daylight Bromide Enlarging Apparatus, reproduced herein, serves to illustrate the use of a hand or view camera for negative enlarging. The camera is arranged before the window in exactly the same manner as for Bromide enlarging, only you must be more particular about having the room perfectly dark. This is important, as the dry plate which is to be used is about twenty times more sensitive than the Bromide paper, and if the room is not perfectly light-tight there is danger of fogging the plate.

821. **The Easel.**—For the easel, you may use an ordinary box, or construct a regular easel as shown in Illustration No. 56. In either case instead of covering the easel with white cardboard, cover it with a dark cardboard, or dark paper, as the dry plate is so very sensitive, that the white cardboard will cause halation, and probably fog.

822. **Focusing.**—Place the transparency in the camera, in exactly the same manner followed for Bromide enlarging, with the film side facing the lens. Place the easel directly in front of the camera and within two feet of it. Rack out the bellows, or move the easel backward or forward, until the desired enlargement is obtained. The size is controlled by the distance between the lens and the easel. In obtaining the focus, attach to the easel a white card of the same size and thickness as the plate to be exposed. This will give a perfect focus. To attach this card use thumb-tacks, as they have larger heads, and will hold the card more firmly.

823. Place a tack about one inch from each corner of the bottom of outline of the negative on the screen, indicating where the card should be placed. These tacks serve as a support, and hold the card firmly, and also indicate where the sensitized plate must be placed. After obtaining the focus, attach the plate to the screen. First, however, cap the lens, or close the shutter, and exclude all light from the room. Remove the cardboard, take the plate to be exposed and place the lower edge upon the thumb-tacks, adjusting it to the same position occupied by the cardboard. Place another thumb-tack at the top, at the center of the plate, to hold it securely for the exposure.

824. When a little light for the arranging of the plate is desired, use a ruby-lamp within a few feet of the easel. This is not often necessary as the plate can usually be arranged without a light of any kind.

825. **Exposure.**—The exposure depends on the quality of the transparency, and the strength of the light employed. A medium strength negative may require four seconds exposure, or it may require eight seconds, all depending upon the nature of the illuminant. A hard or contrasty negative will require double the exposure of a soft snappy one, and where artificial light is employed, four times the exposure necessary for daylight will be required.

826. The exact time can only be ascertained by experience. It is best for the first experiments to use a plate of small size. Place it in the center of the enlarged image; with a cardboard, cover one-half of this plate and give four seconds exposure; then remove the cardboard and give the entire plate four seconds more exposure. One-half the plate will have been exposed four seconds and the other half eight seconds. Develop this plate, and the result should indicate the necessary exposure. If the half given four seconds exposure is fully-timed, the portion given eight seconds exposure will be fogged and flat. If, on the other hand, the portion given four seconds exposure is found lacking, and not strong, this will indicate that it was insufficient. Should the portion given eight seconds be full of detail



STUDY

STUDY No. 14—See Page 358

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and of good strength, it will show that eight seconds is nearly the correct exposure. In a word, the result of this experiment will determine the proper exposure required for the transparency being used.

827. **Developing.**—The enlarged negative, as well as the transparency, can be developed in *normal* developer, with a little Bromide added. The Bromide will hold the shadows clear, and prevent fog, thus giving more snap and vigor to the negative. Without Bromide, even with the correct exposure, the negative is apt to be flat and weak. The latitude in enlarged negatives, especially where fast plates are used, is not so great as when photographing direct, because the contrasts between the high-lights and shadows are not so pronounced, as they all appear on a flat surface.

828. Negatives which vary in exposure, whether over or under-exposed, especially over-exposed, may be controlled in the developing if treated according to the exposure. (See "Developing Over and Under-exposures," Vol. II.) Enlarged negatives should always be developed a little stronger than smaller negatives. The *Universal Pyro Developer*, formula for which is given in Volume II, should be used, as the Pyro gives more color, thus producing better printing quality in the negative. This is essential, especially for large negatives.

829. **Artificial Light.**—The same method followed in Bromide enlarging by artificial light may be used for negative enlarging, but more care must be exercised about the darkness of the room, as the dry plate is twenty times more sensitive than Bromide paper, and the least trace of actinic light will fog the plate. The placing of the transparency in the camera, the focusing and exposing, are exactly the same as for Bromide enlarging, with the exception that the dry plate does not require as long an exposure as Bromide paper; but the exposure for negatives enlarged by artificial light, should be four times as much as for daylight. (For detailed instruction regarding the use of artificial light see "Bromide Enlarging by Artificial Light.")

830. **Making an Enlarged Transparency.**—With either of the methods employed for making the enlarged negative, an enlarged transparency can be made, and from this transparency, the large negative is made by contact printing. Where the small transparency was previously used for enlarging, you now use the original negative, and make the enlarged transparency in exactly the same manner as the enlarged negative. In exposing for the large transparency, give the same time as for the enlarged negative, and in developing, carry it a trifle farther than for ordinary negatives, thus allowing for the reproduction onto another large plate, thereby producing a new negative.

831. **Making the Negative by Contact from the Large Transparency.**—To make the enlarged negative from this enlarged transparency, place the transparency in a printing-frame having good, stiff springs. Place the unexposed plate on top of this transparency, film to film. Cover the sensitive plate with a sheet of black paper and then clamp firmly. Be careful to dust both transparency and plate free of specks; also be sure that the back (the glass side) of the transparency has been thoroughly cleaned, as the least marking, or particle of dust or dirt, will show in the enlarged negative. It is advisable, in order to produce perfect contact, to use a soft pad between the unexposed plate and the back of the printing-frame. Unless the negative and transparency are in perfect contact, that part not in contact will be out of focus and appear blurred.

832. **Making the Exposure.**—The exposure should be made by artificial light, and as the large size plate will require double the exposure of the small one, you must time accordingly.

833. This last method of negative enlarging, as previously stated, requires two large plates, and while it is a trifle more expensive, yet, for the very finest results it is the best, less grain being produced in this way than if the transparency were made from the original negative by contact and then enlarged from this small transparency.

834. **Making Transparencies on Film.**—Films may be

employed for making a small transparency, either from a film or glass negative, and the film may then be enlarged on a glass plate, the same as though a glass transparency were used.

835. Making Small Size Negatives from Large Ones.—

For this work only the regular camera with the regular lens fitted to it will be required, providing it will make a picture as large as the size desired to reduce to. In this case, when reducing, a lens as large as that used in making the original is not needed, but only one large enough to make the size picture required. For example, to reduce an 8 x 10 negative to 5 x 7, any lens that will cover a 5 x 7 plate may be used.

836. Copying the Negative.—In making a reduced negative from one of larger size, instead of making a contact transparency, copy the negative in the same manner as described later for copying negatives for lantern-slides, thus making a small transparency of the size desired. From this small transparency make a small negative by contact, and develop in the ordinary way.

CHAPTER XL.

Difficulties—Negative Enlarging.

837. Securing Proper Illumination on Negative or Transparency to be Enlarged.—Follow closely the instructions given in regard to using a *reflector* for daylight. Adjust this properly and this difficulty will be readily overcome.

838. Judging Proper Illumination when Enlarging from Negative or Transparency by Artificial Light.—Be careful to place the artificial light far enough away from the ground-glass to illuminate it evenly *all over*. If a reflector or a white lined box is used, and care is taken to have the light far enough away from the ground-glass, an even illumination will be produced. If either condensers, the Folmer and Schwing enlarging apparatus, or the home-made enlarging camera are used, then by means of the number of ground-glasses employed you have absolute control over the illumination and will experience no trouble.

839. Obtaining a Sharp Transparency.—When making a small transparency it is absolutely necessary that the plate be in perfect contact with the negative. By using a printing-frame, with good stiff springs giving plenty of pressure, this is very easily accomplished. Usually this difficulty presents itself more frequently where transparencies are made from film negatives, yet the film can be brought into absolute contact by backing, and having sufficiently strong springs in the back of your printing-frame. If these springs are rather weak, bend them back a trifle and they will give better pressure.

840. Obtaining Sharp Enlarged Transparency.—This can be accomplished if great care is exercised about focusing, and by using a small enough stop.

841. Overcoming Distortion.—Be careful to place the camera and negative or transparency in an absolutely perpendicular position—the negative or transparency parallel with the camera—the distortion will then be overcome.

842. Producing a Sharp Image when Enlarging from a Small Transparency.—Focus carefully with the lens wide open. Get the image just as sharp as possible on the ground-glass, and use a stop sufficiently small to sharpen the entire image.

843. Proper Exposure.—This, like making regular exposures,

requires practice, and it is necessary that the results be closely observed. Keep a memorandum of the conditions of light, strength of negative, and also exposures given. If, upon developing the negatives, they prove to be under or over-exposed, estimate accordingly the next time an exposure is made, whether it be a transparency by contact or a transparency by enlargement.

844. Transparency Plate too Dense.—This is either caused by over-exposure and over-development, or even by proper exposure and over-development. With a little practice this difficulty will be readily overcome. Should the plate be too dense reduce it with Red Prussiate Reducer, (See Vol. II).

Transparency Plate too Contrasty.—This is generally caused by under-exposure, but proper exposure and the using of too much restrainer (Bromide solution) will also cause it.

845. Negative from Transparency Flat.—If the transparency is a weak, thin one, the enlarged negative will also be weak, thin and flat. If over-exposed, whether in making the enlargement from a large transparency, or enlarging from a small transparency, and the proper method in developing for over-exposure is not observed, the result will be flat negatives. When developing negatives from thin, flat transparencies use a strong restrained developer; this will assist in giving contrast.

846. Enlarged Negative from Transparency Showing No Detail in the Shadows.—If the transparency has no detail, which would be the case in an exceedingly contrasty or under-exposed transparency, there would be little or no detail in the enlarged negative. Under-exposure in the enlarged negative would also cause a lack of detail.

847. High-lights in Both Transparency and Enlarged Negative Hazy and Flat.—A certain sign that both the transparency and enlarged negative are over-exposed; or if the transparency is brilliant, has clear shadows, and only the enlarged negative has high-lights that are flat and hazy, this would indicate that the enlarged negative was over-exposed. By using slow plates for making the transparencies the flatness will be overcome as there is much more latitude to the exposure.

848. Shadows not Transparent Enough.—This effect is produced both in the transparency and enlarged negative by over-exposure. If, however, the transparencies are over-exposed or over-printed, the enlarged negative is sure to have shadows that are not transparent, even though the enlarged negative be properly exposed.

849. Enlarged Negative too Gray in Color.—To overcome this difficulty, simply weaken the Sulphite of Soda solution, as the Sulphite of Soda controls the color.

850. **When Using Artificial Light Other than Arc-light the Entire Ground-glass not Evenly Illuminated.**—By using opal glass in place of ground-glass and placing the light far enough away from the glass, this difficulty can be overcome almost entirely. It is harder, however, to evenly illuminate the negative by artificial light than it is by daylight. A good reflector is necessary; therefore, line the entire box that holds the light with asbestos or tin. The white box will then act as a reflector and more evenly illuminate the ground or opal glass.

851. **Proper Exposure for Transparencies.**—When printing the transparency, whether by contact or by enlarging, a number of experiments will be found advisable. Be guided by the results thus obtained and govern the exposure for all future results accordingly.

852. **Pin-Holes in Enlarged Negative, Which are Hardly Visible in the Transparency.**—These pin-holes are caused by dust on the negative or transparency plate when making the transparency. When the enlarged negative is made these pin-holes are also enlarged, and will show very much exaggerated in the enlarged negative. Carefully dust the plates, negative, and printing-frame, also the inside of the camera, and this defect will be prevented.

853. **Streaks and Marks on the Enlarged Negative.**—These are generally caused by dirt on the back or front of the negative or transparency. Be sure that both the front and back of the negative are perfectly clean.

854. **Spots Transparent and Semi-Transparent that are not Caused by Dust.**—These are generally caused by particles of dirt in the developer, or air-bells gathering on the plate when first placed in the developer. A good plan is to keep a piece of absorbent cotton thoroughly saturated with developer in the developing tray, and to swab the entire surface of the plate with the absorbent cotton. This will remove all tiny air-bells and dirt.

855. **Center of Large Negative Seems to Have More Exposure Than the Edges.**—This is because the light is not evenly distributed on the ground-glass and negative, and will occur more often when using artificial light. To overcome this it will be necessary to place the light further away from the ground-glass.

856. **Enlarged Negative Very Thin and Full of Detail in the Shadows.**—This is a certain sign that the plate was over-exposed, that it was not treated according to exposure while developing, and was not developed far enough. It is always advisable to over-develop an over-exposure, and then reduce, according to the instructions given in lesson on Reducing.

857. **Transparency Very Thin, Shadows Filled with Detail.**—The remedy for the preceding difficulty also covers this one.

858. Enlarged Negative Very Grainy.—If the ground-glass or tissue paper is too near the transparency you are enlarging, or the negative from which the enlarged transparency is being made, the grain of the ground-glass or texture of the paper will show in focusing, and this will, of course, show in the enlarged negative. Transparencies which are under-exposed and then forced in development will also have considerable more grain than when they are properly exposed, and this grain will show stronger in the enlarged negative; therefore, aim for correct exposure for your transparency.

859. Black Comet-Like Specks in the Enlarged Negative and also in the Large and Small Transparency.—This is generally caused by iron rust in the water or undissolved particles of Pyro. If these settle on the plate when it is first placed in the developer, they are apt to cause these spots. Filter the developer.

860. White Spots, Irregular in Shape, in the Enlarged Negative.—Caused by iron rust in the developer or wash waters. These spots will appear opaque on the transparency, and prevent the light from passing through them, thus producing light spots, which will result in black spots on the finished print.

861. Light Transparent Spots on the Transparency.—These are caused by small air-bells gathering on the plate when developing, and which, when enlarged, will produce black spots on the enlarged negative, resulting in white spots on the finished print. Carefully dust the negative and transparency and also filter the developer.

862. Enlarged Negative too Strong in Color—Yellow.—Strengthen the Sulphite of Soda and this will be readily overcome. Also bear in mind that Sulphite of Soda, even though it tests full strength, if it has been made up for some time and is an old solution, will not have the same chemical value as a fresh solution, and should be discarded and a fresh solution be made up.

863. Negatives that have been Properly Exposed when Enlarging from a Small Transparency, or a Transparency that has been Properly Exposed when Enlarging from a Small Negative, Appearing Hazy or Fogged.—This would result if the light were allowed to enter between the lens and the negative, or transparency. A hood or cloth must be used over the space between the lens and negative or transparency being enlarged from.

864. Kerosene Light Flickers.—This is a certain sign that the box is not properly ventilated. It must be ventilated from the bottom and also from the top in order to have the lamp burn steady. This will also apply to gaslight.

CHAPTER XLI.

Lantern-Slide Making.

Part I.

Introduction.

865. A lantern-slide is a positive transparency on a glass $3\frac{1}{4} \times 4$ inches square. The picture itself is smaller, and may be any shape preferred by the maker, and any size up to $2\frac{3}{4}$ inches each way. The edges of the picture are defined by an opening of the desired size, cut in a piece of opaque paper. This paper is laid on the slide, and masks out the edges and parts not wanted in the picture. Over the paper mask a piece of clear glass is laid, of the same size as the transparency, and the two glasses are firmly bound together by pasting a strip of paper around the edges. This covered glass serves the double purpose of holding the mask in position, and protecting the film from injury. Lantern-slide making is nothing more or less than printing on glass instead of paper. In its simplest form it is not a particle more difficult than printing on a developing paper. The lantern-slide is, therefore, simply a positive picture on glass.

866. **Making a Lantern-Slide.**—Lantern-slides may be printed from a negative either by contact or by reduction. When printing by contact, the negative is laid in an ordinary printing-frame, film side up, and upon this side is placed a lantern-plate, film side down, thus bringing both plates film to film. The back is placed in the printing-frame and a short exposure given to artificial light. In making a slide by reduction, the negative is placed before

a window and is focused with a camera. A lantern plate is then placed in the plate-holder, and an exposure made on the plate. The contact method is used for making slides from small negatives. The reduction method is generally a necessity, as almost all negatives are larger than the lantern-slide, and then the latter method must be employed.

Part II.

Apparatus.

867. **The Camera.**—The only apparatus required is a camera that is large enough to take at least a 4 x 5 plate. A larger camera may be employed, however, but is not necessary. A tripod or camera stand may be used, but, as it is essential that all lines be accurate and distortion entirely avoided, a very inexpensive and convenient outfit can be made as follows:

868. **Platform.**—Secure a smooth, planed board, about 12 inches wide, 3 feet long, and 1 inch thick. On each edge of this board, fit a strip lengthwise, to be used as guides for sliding the camera backward and forward; into this fit a platform or box as wide as the distance between the two strips, as long as the length of the camera to be employed and about 4 inches high. Bore a $\frac{3}{8}$ -inch hole in the center of the cover of the box and, with the regular tripod screw, attach the camera to this platform, making it rigid. This box or platform fitting between the strips on the board will insure perfect lines of the subject on the ground-glass. On one end of this board at the sides attach two upright standards, about 14 inches high. These standards contain a groove the thickness of an ordinary 8 x 10 printing-frame, used to hold the negative for copying, and which latter will be termed the negative holder. By means of this standard attached to the copying board, the negative will be perfectly perpendicular with the camera and on a line with the lens. If it is not on a perfect level with the lens raise the nega-

tive to be copied, by blocking up underneath the negative holder as much as is required to give you perfect alignment (See Illustration No. 20).

869. **Preparing the Negative-Holder.**—If the largest plate from which a lantern-slide is to be made is 5 x 7 inches, provide an 8 x 10 sheet of ground-glass, or flow a piece of plain glass with ground-glass substitute. When the substitute is set and dry, which requires only a few minutes, place the glass in an 8 x 10 printing-frame and fasten it with one tack on each end. In case neither ground-glass nor substitute can be obtained, a very fine quality of tissue paper will answer, pasted over the outside of the printing-frame.

870. Place the negative to be copied in a 5 x 7 printing frame, film side out. Use thumb tacks to hold the negatives in the frame. Having attached the negative to the printing-frame, place this small frame inside the 8 x 10 frame, with the film side facing the camera. This will give a space equal to the thickness of the frame between the negative and the ground-glass (or tissue paper). This is important, as the distance between the two throws the ground-glass out of focus when the negative is sharp. The ground-glass, or tissue, serves as a diffusing screen and equalizes the light on the negative. To place the negative too close to the ground-glass would bring the latter in focus with the negative and give it a coarse grain. This is avoided by the thickness of the printing-frame providing a sufficient distance between the two to overcome this grain. The two frames are held together by means of a heavy rubber band around both.

871. Place the negative-holder in the grooves of the standard, these grooves being provided for this purpose on the end of the copying board, and arrange this board before a window with an unobstructed light, a north window preferred, when ready for copying.

872. **Using the Copying-Board.**—Place the copying-board on a table, which must be as high as the window. If the table is not of the proper height, the board must be raised to a height on a level with the window, and the end

of the board containing the negative placed close to the window glass. Then focus the negative on the ground-glass.

873. After obtaining the focus all surrounding light must be excluded, and only that which comes through the negative admitted. It is not necessary to darken the room entirely. Draw the opaque curtains; then in order to further exclude the light within the range of the lens, extend two strips from the top of the camera to the top of the printing-frame. Over these strips place an opaque cloth. Allow it to hang on both sides. In this way all the direct light except that coming through the negative is excluded. After obtaining the focus, make the exposure.

874. The negative-holder attachment to the copying-board may be done away with if desired and the negative-holder placed in the window. In this case have the edge of the negative-holder rest on the window sash, and hold it close to the window glass by means of a strong cord stretched across the window and on a line with the upper edge of the small printing-frame. The negative is then ready for copying, and you can use the copying-board without the negative-holder attachment, or your regular camera attached to a tripod or camera stand, and arranged before the window in exactly the same manner as if the negative-holder were attached to the copying-board. When the latter method is employed, the copying-board or camera must be on a perfect level and alignment with the negative placed in the window, otherwise you will be troubled with distortion. The use of the copying-board is, therefore, the best, as it is very easily constructed, all such difficulties are overcome, and the outfit is always ready for use.

875. **Lens Necessary for Reducing.**—Any ordinary rectilinear lens fitted to a long bellows camera is all that is necessary. There is no need for an anastigmat lens, but of course any high-class modern lens can be employed, and has this advantage, that it can be used with a large stop, which will be found of great benefit, especially when artificial light is employed. When a hand camera is used a lens of about 5 inch focus is most convenient, as this does not

make the whole arrangement unwieldy. A long focus lens will give equally good slides, but may require a distance between the negative and lens which would be somewhat inconvenient. If the bellows of the camera is not long enough, a supplementary copying-lens may be used; this lens fits over the regular lens employed, and enables you to use any camera for this work.

876. Proper Light for Making Slides by Contact.—It is advisable to use an artificial light for making slides by contact; either candle, kerosene lamp, electric or gas-light will do, and frequently the simple light of a match will give sufficient exposure to print the slide.

877. Proper Light for Making Slides by Reduction.—A north light is always best for lantern-slide work in daylight, because it gives more even illumination and there are no direct rays of the sun.

878. It is essential that the negative, from which the slide is to be made, faces the clear sky, without any obstruction, such as trees, buildings, etc. Such obstructions injure the light by false reflections, or by cutting off the light, reducing its intensity. If an unobstructed view of the sky cannot be had, then a simple reflector can be constructed, by placing a large white cardboard outside the window, at an angle of 45°. This will evenly reflect a good strong light over the entire negative.

879. Use of Artificial Light.—The method employed for daylight work can be followed in making slides from negatives by artificial light. A large kerosene lamp, electric or gas-light can be used instead of a window. When a kerosene lamp or gas-light is used, neither one should be placed close to the negative, as the light will not be evenly distributed; but arrange the ends of the box so that the light will be reflected to the rear, and then work by reflected light.

880. It is well to place a reflector behind the lamps, to throw light against the asbestos. This will strengthen the light and also give a more even illumination. An apparatus is shown in Illustration No. 19 for the use of gaslight.

In this case there are two lights, one placed in each end of the box. The box is made of tin, curved so as to reflect the light uniformly onto the negative. The front being fitted with a ground-glass, all that is required is to place the negative in a printing-frame, with the thickness of the frame between the ground-glass and negative; place your copying-board against this light and extend the camera to a distance sufficient to give you the necessary focus. Finally extend the strips from camera to the negative frame, cover with opaque cloth, and all is ready for the exposure. (See Page 282.)

881. **Making Slides From Copies.**—To copy a picture and from this copy make a lantern-slide, first make a negative from the picture. Proceed exactly as for copying an ordinary picture (See instructions on Copying). The picture must be copied the exact size of the lantern-slide, which is $3\frac{1}{4} \times 4$ inches, allowing $\frac{1}{4}$ inch margin for the mask on the slide. The plate should be developed in the ordinary way. Carry the negative to the same strength in development as though prints were to be made from it. When the negative is dry, make the lantern-slide, using the method already described for contact printing.

882. **Plates to Use.**—In the producing of perfect lantern-slides it is essential to use plates especially prepared for this purpose. These plates are made of extra thin glass, and are coated with a special emulsion which is very thin and has little or no grain. Almost all manufacturers of dry plates make lantern-slide plates. These have an emulsion, on which rich, black tones can be produced. There are also a number of brands on which the tones can be varied from black to brown, simply by changing the developer. The beginner is advised to use the ordinary lantern-slide plate, which can be purchased from any photo-supply dealer.

883. For the beginner who has had no experience, the regular dry plates are best for the first experiments, as they cost less than the lantern-slide plates, and are generally much more simple to handle. After becoming familiar with the work, the plates made for the purpose should be used.

CHAPTER XLII.

Lantern-Slide Making—General Instruction.

884. **Exposure for Contact Printing.**—When making a lantern-slide by contact, the exposure should be very much less than when photographing a negative. Proceed to the dark-room, and by the light of the ruby-lamp only, place the negative from which the lantern-slide is to be made into an ordinary printing-frame; next place the lantern-slide plate (or ordinary plate if the lantern-slide plate is not being used), film to film, in the frame, being careful to center the unexposed plate on the negative. Lay a pad or piece of black paper over the back of the unexposed plate; place the back of the printing-frame in position, and fasten down the springs. Then, by the light of a match or any artificial light, expose the plate at a distance of from two to three feet, or at arm's length, from the light.

885. If a 16-candle power electric light is being used in the dark-room, hold the frame about three feet from this light, and expose from one to two seconds, the length of exposure depending entirely upon the density of the negative and the speed of the plate used. If the negative is a slow printing one, it may require a longer exposure; if thin or quick printing, it will require considerable less. If the light of a match is used, it will take from two to three seconds at a distance of one foot from the negative. If the regular fast plates are used, one second exposure is sufficient.

886. This key to the length of exposure applies where ordinary plates are being used. If the regular lantern-slide plates are used, it will require at least double this, as they are much slower.

887. As before stated, an ordinary 4 x 5 slow plate can

be used for making the negative, and a regular lantern-slide $3\frac{1}{4} \times 4$ for the slide. After a few experiments, and keeping record of the results, it will be easy to judge the correct length of exposure.

888. Remember that both the negative and the lantern-slide plate must be carefully dusted when placing in the printing-frame. The slide plate should be laid gently on top of the negative, so that the plate will cover that part of the picture in the negative which is to appear on the slide. If the negative is larger than the lantern-slide plate, be careful not to slide the latter about on the negative because if there should happen to be the slightest particle of grit or dirt between the two surfaces, one or both of the films would be injured.

889. Always be careful to have the distance the same from the light, as a little change in the distance of the printing-frame from the light will make a great difference in the length of exposure that the plate receives. Alter the time only to suit the different negatives.

890. A good plan is to place a box or other support a certain distance from the light; drive a nail a trifle above the center, and put a picture hook or screw-eye into one end of the printing-frame, by which it can be hung up on the nail in the box at exact distance from the light.

891. **Exposing or Printing When Making Slides by Reduction.**—The method of printing lantern-slides by contact, as previously described, has a limitation. The largest possible picture on a lantern-plate cannot well exceed three inches in width or height; it would only show a little more than half of the picture from a 4×5 negative, while, with negatives of any larger size, so little of the subject would appear on the slide that this method for all but a few exceptional cases is impracticable. Therefore, all such slides must be made by "*reduction*," as it is called. It takes a little longer, and is a little more trouble, but the resulting slides, even when the size of the picture on the negative does not necessitate it, are equally as good, and often better than if they were made by contact.



"LULLABY"

STUDY NO. 15—See Page 358

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892. The other method has been previously referred to as "*printing*." This may be called "*photographing*."

893. Having prepared the apparatus according to the instructions previously given, take the printing-frame containing the negative and place it in the standard at the end of the board. Arrange it facing the window, with the film side of negative towards the camera, the camera being placed at the other end of the board. Observe the image on the ground-glass and secure a sharp focus, and with a rule measure the size of the image. If it is too large, draw the camera back from the negative and proceed to focus again; if too small, push the camera towards the negative. Do this until the desired size suitable for the lantern-slide is secured. It is very essential that a sharp focus be secured, for when the slide is projected on a screen, and, therefore, magnified many times, unless it is sharp it will appear very blurry. If any difficulty is experienced in focusing, it is well to use a magnifying-glass, as this will magnify the image on the ground-glass and assist in obtaining a sharper focus. After focusing, we would advise a smaller stop than for ordinary purposes. This will help to secure absolute sharpness.

894. In order that no white light be admitted between the negative and camera, extend two thin slats or strips of wood from the printing-frame containing the negative to the top of the camera. Over these strips throw a focusing-cloth or any black cloth, to form a hood. This will exclude all light except that coming through the negative.

895. It is advisable always to focus the image as sharp as possible without the use of a stop. If it is necessary to use an extremely small stop, there is danger of a loss of crispness. It is also a good plan to stick a lantern-slide mask on the center of the ground-glass in the camera, and use this for the guide in obtaining the exact size of the view desired. By excluding all light from the lens, except that which comes through the negative, the slides will be bright and clean.

896. Another very convenient way to make slides by

reduction, is to have two view cameras, one larger than the other. Remove the front board from the larger camera, place the ground-glass end towards the light, and then place the smaller camera in front of the larger one, with the lens pointing through what was formerly the front of the large camera. In other words, place the lens of the smaller camera through the opening from which the lens of the larger camera has been removed. By throwing a dark cloth over the two cameras all light is excluded. Take an old double plate-holder, cut out the division and withdraw both slides. Place your negative in the holder in exactly the same manner as though an exposure were to be made, the film side towards the front of the camera. The ground-glass will then come between the negative and the light, acting as a diffusing screen, and the diffused light will evenly illuminate the negative. With the second camera make the copy.

897. **Copying With a Box.**—Another very simple method is as follows: Procure an ordinary box, about 8 inches square and 14 inches long. Close one end of this box, and cut an opening in it the size of the plates to be copied. A box of this size is suitable for copying 4 x 5 and 5 x 7 negatives. On the outside of this opening fit a grooved strip, top and bottom; in this groove slide your negative to be copied. Paint the inside of the box a dead black, to prevent reflections.

898. To copy a negative place the box on a table, close to a window, and on a level with it. Extend the bellows of the camera and place one end inside of the box, telescoping it. The box will exclude all light from the lens, except what comes through the negative, and good slides can be made in this way. It will be necessary, in order to evenly illuminate the entire negative, to place the ground-glass frame in front of the negative—within one inch of it—just the same as if the copying-board were employed.

899. Taking it for granted that the image has been reduced to the correct size, and the proper focus procured, all is now ready for exposure. To do this, use a cap on the

lens or the regular shutter. When using the cap run your hand underneath the cloth and take off the cap. In doing so, be careful not to shake the apparatus. If properly made and set up, a slight shake would have no effect on the slide, as both the negative and slide would receive the same movement. Whenever it is possible make exposures with the shutter on the lens, thus *avoiding* any possible jarring of the camera.

900. **Length of Exposure.**—So many factors have to be taken into consideration, that it is not possible to state definitely the proper length of exposure, but one or two plates devoted to testing this will soon teach one to judge properly the exposure necessary. This same method can be applied when using artificial light. In Illustration No. 13 is shown a convenient box for electric or lamp-light, which must be placed in position behind the negative and ground-glass, the light, as already explained, being placed far enough away from the ground-glass to illuminate evenly the entire ground-glass and negative.

901. The length of exposure by artificial or daylight depends largely upon the strength of the light and density of the negative. The best plan is to sort all the negatives from which slides are to be made, into grades of density. Take one of the most dense and make an exposure from it as a guide. Expose one-fourth of the lantern-plate for five seconds; draw the slide to one-half of the plate and give five seconds more; draw it to three-fourths and give five seconds more; then withdraw the slide completely and give five seconds exposure on the entire plate. The first fourth of the plate will have had 20 seconds, the succeeding fourths 15, 10 and 5 seconds respectively. After development, the time on one portion of this plate should be correct. Use this as a guide. If the negative is very dense give double the time on the test plate. It should then be easy to figure the time on the thinner negatives; for if they are only half as dense only half the exposure will be needed.

902. **Preparing Developer.**—Each plate manufacturer has special formulæ particularly adapted to their own plates,

which are the results of very careful experimenting, guided by a full knowledge of the exact ingredients in the emulsion. The formula recommended by the maker of any particular plate is undoubtedly the best, but the following formula is a good all-round one, and with it fine black tones can be produced. By increasing the exposure, and by the addition of more Bromide of Potassium (10% solution) when developing, warmer tones can be secured.

903. Sulphate of Iron Developer.

Stock Solution No. 1.

Oxalate of Potash	8 ozs.
Citric Acid.....	30 grs.
Ammonium Citrate Solution	1 oz.
Water	15 ozs.

Stock Solution No. 2.

Sulphate of Iron	1 oz.
Sulphuric Acid	5 drops
Water	16 ozs.

Place these solutions in separate bottles, marking them Stock Solution No. 1 and Stock Solution No. 2.

904. **Preparing Ammonium Citrate Solution.**—The Ammonium Citrate Solution is made by dissolving $\frac{1}{4}$ ounce Citric Acid in $1\frac{1}{2}$ ounce of water. Add a few drops of strong ammonia water, enough to neutralize the acid. Then add sufficient water to make two ounces in all. This solution can be purchased all ready prepared, or can be made up as above.

905. **Sulphate of Iron.**—Proto-Sulphate of Iron, should be bright bluish-green crystals which disintergrate in air. Soluble in water. If they are dull and rusty, caused by oxidization, do not use them; get fresh clear crystals.

906. This developer gives fine, black-toned positives, and beginners should not try for other tones until they have absolute control over both exposure and development.

907. **Developing.**—To develop, prepare the developer as follows: Pour 3 ounces of Stock Solution No. 1 into

the graduate; add to this $1\frac{1}{2}$ ounce of Stock Solution No. 2; add 3 drops of a 10% solution of Bromide of Potassium. Place the lantern-slide plate in the tray and pour the developer over the plate in the usual manner, being careful to remove all air-bells.

908. It is a very good plan to have a small piece of absorbent cotton, thoroughly saturated with developer, in the developing tray, using it to swab the entire surface of the plate. This will remove air-bells and dirt. These air-bells or dirt would cause transparent spots on the slides. As lantern-plates are not nearly as rapid as ordinary plates, a brighter developing light can be used. A light made non-actinic by a couple of thicknesses of post-office paper will be safe.

909. With a strong light the development can be watched closely, and stopped when the transparency has reached its best.

910. To more readily see the plate come up, always develop in a white porcelain dish, or have a piece of white paper under the plate, and use a fresh piece for each plate.

911. It is impossible to state a definite time in which the plate must be developed, because this will be found to vary according to the character of the negative from which the slide is being made, the temperature of the solution, and, to a certain extent, according to the subject. Ordinarily, the formula given will furnish a fully developed slide in about five minutes.

912. The principal difficulty will be found in determining how far to carry development. This can only be ascertained by practice.

913. For the first lantern experiments it is advisable to develop the plate until all detail is clearly visible and the transparency appears crisp and snappy. At this stage the plate is developed, but be careful to time the operation of the first experiments. If the plate is too dense, or too thin, after fixing, figure accordingly in developing the next slide.

914. A lantern-slide must be so transparent that when laid upon printed paper the small letters can be easily read

through the transparent shadows; the high-lights, of course, will be slightly denser, but not as much so as in a printing negative.

915. Usually, when the image on the transparency reaches the stage where it begins to veil over, which indicates that it is fully developed, remove the plate from the developer and carefully wash under the faucet for two minutes, with a slow stream only, so as not to injure the film.

916. There is no particular difference between the development of a lantern-slide and an ordinary negative, except that the lantern plate is not carried so far, and that the color of the film is important (that is to say, it must be a pleasing color), whereas in a negative it matters little what the color is, provided it gives good prints.

917. Lantern-slides must be free from fog, which may be caused from over-exposure or over-development. If the slide is over-exposed, add a few drops of bromide to the developer, to prevent fogging, but it is very seldom that such a slide can be made perfect.

918. **Fixing.**—After development is finished, the lantern-slide (for such it now may be called) must be rinsed under the tap and placed in the hypo. An acid hypo should always be used for slides, because it is important to avoid any chance of developer stain.

919. **Preparing Acid Hypo Bath.**—Prepare the following solution:

Sulphite of Soda	2 ozs.
Water	$\frac{1}{2}$ pt.

When this is dissolved, add 2 drams of Sulphuric Acid C. P. Place this in a bottle and mark it Acid Hypo Stock Solution No. 1.

920. Next dissolve 7 oz. of hypo in 16 oz. of water, and add to this from one to two ounces of stock solution No. 1. This will give an Acid Hypo bath, in which the slides will fix in from three to four minutes. It will be better, however, to allow the slides to remain ten minutes, as this will produce clearness and permanency. After fixing, the slides

should be washed even more thoroughly than the regular negatives.

921. Another very good formula for a fixing bath is made up in two solutions.

Solution A:

Water	32 ozs.
Hypo	$\frac{1}{2}$ lb.
Sulphite of Soda	2 ozs.

Solution B:

Water	16 ozs.
Chrome-alum	$\frac{3}{4}$ oz.
Sulphuric acid (conc.)	$\frac{1}{2}$ dr.

While stirring Solution A vigorously, pour in Solution B very slowly. This bath has exceptional keeping qualities, but should be filtered occasionally.

922. Clearing Solution.—All transparency plates should be put through a clearing solution after fixing and washing. Even though they appear of the right tone and color when wet, they sometimes dry up with a veil. The *Clearing Solution* will prevent this, and should be made up as follows: First prepare a saturated solution of Alum and a saturated solution of Citric Acid. Pour into your graduate 4 ounces of the saturated solution of Alum, and 4 ounces of the saturated solution of Citric Acid, adding to this one dram of Hydrochloric Acid. Place the transparency in a clean dish and pour the Clearing Solution over it. Rock the tray gently for a couple of minutes; then wash the plate carefully for ten minutes in running water, or give it a dozen changes, of two minutes each, in clear water. A more simple clearing bath, which is equally as good, will be found in lesson on Reducing, Vol. II.

923. Care must be taken not to scratch or injure the film in any way, or the plate will be unfit for use, as these defects are magnified many times when projected on a screen.

924. When washing the slides in running water, be careful that the stream is not too strong, as it is apt to injure the very delicate film on the transparency.

925. **Toning Slides.**—The black tones which can be obtained with the formula just given are very fine, but for many subjects a warmer color is desirable, and this can be obtained by either toning or by the use of special plates, the image of which can be made warmer by simply increasing the exposure, and developing with a restrained developer. A great many lantern-slide makers follow this latter method, by which very fine colors indeed can be obtained.

926. The toning, by development process, has the advantage that the color is a pure one throughout the entire image. The color of the deep shadows is the same as the faintest deposit on the high-lights, which is not always the case when a slide is toned after development.

927. **Developer for Black Tones.**—The following developing formula will give good results:

Stock Solution No. 1.

Pure Water	12 ozs.
Sulphite of Soda, Anhydrous	3 ozs.
Hydroquinon	75 grs.

Stock Solution No. 2.

Pure Water	8 ozs.
Carbonate of Potassium	2 ozs.
Bromide of Potassium	15 grs.

To develop take of No. 1 Stock Solution, 3 ounces; of No. 2, two ounces.

928. **Developer for Warm Tones.**

Stock Solution No. 1.

Pure Water	8 ozs.
Hydroquinon	25 grs.
Sulphite of Soda, Anhydrous	25 grs.
Bromide of Potassium	12 grs.
Citric Acid	6 grs.

Stock Solution No. 2.

Pure Water	8 ozs.
Carbonate of Soda, Anhydrous	240 grs.

To develop take equal parts. For still warmer tones it will be necessary to reduce the amount of Sulphite.

929. In making the exposure, for example, if it were to take two seconds exposure with a 16-candle power electric light for black tones, it would take three seconds for the warm tones. Bear in mind, that the resulting tone depends more upon the correctness of exposure; hence judgment and practice are necessary with the varying characters of negatives.

930. If there is any doubt as to the time of exposure required for a certain negative, the aim should be to under-expose rather than over-expose. A slightly under-exposed lantern-slide is always more satisfactory than an over-timed one, because of the distinctness of the image when thrown on the screen.

931. The temperature of the developers should be 70° to 75° Fahr. With the formulæ just given, and the exposure correct, the time of development would be about three minutes for either the black or warm tones.

Note.—For further formulæ of developers for lantern-plates, see Vol. II.

CHAPTER XLIII.

Lantern-Slide Making.

Clouds in Lantern-Slides.

932. **Introduction.**—Landscape lantern-slides are rarely seen without clouds, as they add materially to the general appearance of the view. There is nothing that will mar the appearance of a scene so much as a flat, chalky white sky, or even a mottled effect in the sky portion.

933. Wherever possible, one should aim to secure clouds in the original negative with the landscape, for by so doing a large amount of subsequent work will be obviated. By employing the orthochromatic plate and a ray-filter the securing of clouds in landscape negatives is an easy matter, but when occasion arises where clouds do not exist in the negative or print from which the lantern-slide is being made, some means must be employed to combine clouds with the foreground, thus producing a complete and pleasing slide.

934. **Sky Denser Than Foreground.**—There are cases where cloud portions of landscape negatives are so much more opaque than the foreground, that they are not well defined in the slide. In such a case the sky portion of the landscape negative should be carefully reduced with Potassium Ferricyanide or Persulphate of Ammonia (see Reducing, Volume II) until the clouds assume an opacity of equal printing value with the landscape portion. There are cases in which the sky of the negative is only a trifle denser than the landscape, in which case it is not desirable to reduce that portion. It would be advisable, under such con-

ditions, when making the slide, to shade the landscape so that the denser part (the sky) of the negative may have a few seconds additional exposure.

935. **Introducing Clouds Into Slides by Reduction.**—There will always be a certain number of slides which will require the introduction of clouds from other negatives. There are two methods generally employed, whereby the best of results may be secured: The clouds may be printed on a separate lantern plate from a specially made cloud negative, and this cloud slide used as a cover-glass, or, the clouds may be printed on the same plate as the landscape portion by double printing.

936. **Cover-Glass Method by Reduction.**—This method requires a variety of cloud negatives from which to select, in order to obtain a suitable cloud effect for any particular landscape. Chapter XIII, of Volume III, gives detailed instruction as to the various methods of producing cloud negatives, and also treats upon the various forms of clouds. Persons desiring to secure a representative collection of cloud negatives should study the instruction given in Volume III. It will be advisable to make prints from each of the cloud negatives, and mount these in an album, placing underneath each print the time of day the negative was taken, and the direction of light. If this is done there will be no danger of contradictory cloud effects being used in making the slide. If any of the landscape shows the cloud negative it may be blocked out by sticking some non-actinic paper upon the back of the negative.

937. **The Landscape Slide.**—For this method the sky in the landscape slide should be represented by perfectly clear glass. If, for any reason, the sky should be a trifle dense, reduce it or clear it away by the application of Ferricyanide reducer, applied with a small tuft of cotton. In making the landscape slide see that the sky part of the negative is perfectly opaque; then the slide will be represented by absolutely pure glass. The slide should be washed and dried in the usual manner.

938. **Cloud Slide.**—To make the cloud portion, take



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another lantern-plate, and, having selected a suitable cloud negative, make a lantern-slide of this. A cloud negative should be adjusted in the camera, so as to occupy the position on the plate that will enable it to register in the clear portion of the landscape slide. This may be accomplished by holding the landscape slide over the image of the cloud negative shown on the ground-glass. When proper adjustment has been made of the sky on the ground-glass, proceed to make the exposure and develop the plate.

939. **Matching Sky With Landscape.**—Care should be taken to work under the same conditions in making the sky slide as when making the landscape, so that the colors of both may be the same. When the slide has been fixed it should be compared with the landscape portion, to see that the two correspond in density. The sky slide may require a slight intensification, or, on the other hand, it may be a little too dense, necessitating a little reduction.

940. When both of the slides are of equal density place them back to back, with the edges of the slides even. The clouds should not overlap the landscape. If they do, take a tuft of cotton, dipped in Ferricyanide reducer, and, still holding the slides back to back, carefully reduce the part of the sky slide that overlaps the landscape. The reducer should not be used too strong, and care must be taken that none of it reaches the landscape slide by capillary attraction.

941. The two slides should now be dried and bound film to film. This is the best method of obtaining clouds in lantern-slides, and its only drawback is the difficulty which one may experience in being able to get the two slides of exactly the same color when a warm tone is desired. But this slight objection may be overcome by exposing the sky and landscape plates, one after the other, and developing them together.

942. **Sky and Landscape on Same Slide.**—A method of printing the clouds on the same slide as the landscape, although not quite as certain as the preceding method, is one which will prove very satisfactory to the advanced

worker. The cloud negative should, of course, be selected to match the landscape, and a mask then prepared with which to shade the landscape portion during the exposure of the cloud negative. To prepare this mask, take a piece of non-actinic paper, lay it over the landscape negative, and holding the negative up to a strong light, roughly trace on the paper, with a pencil, the outline of the landscape where it comes against the sky. Cutting along this line will give two masks, one for the sky and the other for the landscape. For convenience the landscape mask may be gummed on a piece of cardboard, but the outline of the landscape should project beyond this cardboard, so it will be a little flexible and not have a thick edge.

943. Place the landscape negative in position, and expose on the lantern-plate in the usual manner. Bear in mind, that the same necessity exists in this method for having the sky appear as clear glass—in order that a brilliant result be obtained—as in the method previously described. Having exposed the landscape negative close the shutter and remove the landscape negative and insert the cloud negative, placing it in the same relative position occupied by the landscape negative. Now expose on the cloud negative about one-third the exposure given the landscape negative, holding the cardboard mask an inch or so in front of the cloud negative, so that it covers that portion corresponding to the landscape in the landscape negative. The mask should be kept moving slightly up and down, so a perfect vignetting and blending of the sky and the landscape is secured. A little practice will soon enable one to place clouds in landscape slides in a very neat manner; yet, for the beginner this method is not as easy as the one first described.

944. **Introducing Clouds Into Slides by Contact.**—Either of the preceding methods described for combining clouds with landscapes in slides is applicable to the making of slides by contact as well as by the reduction method. The same principles hold good in both cases.

945. **Cover-Glass Method by Contact.**—The landscape slide should be exposed, the sky portion, of course, being

held back entirely, so that when developed the sky of the slide will be perfectly clear glass. Now, place (preferably) a 4 x 5 cloud negative in a printing-frame, and adjust the landscape slide, with its back (the glass side) next to the film of the cloud negative, so the clouds will come in proper position. Carefully observe the location of the landscape slide. Replace the landscape slide with a lantern-slide plate. Insert the back of the printing-frame and expose as usual but at a farther distance from the light. During the exposure shade the foreground or landscape portion, so there will be no impression made on this section.

946. Another method of securing the cloud slide is to adjust the landscape slide on the cloud negative, and then on top of this place the sensitive lantern-slide plate. Insert and fasten the back in the frame. If there should be any transparent spots in the landscape, these should be covered with opaque paper. Make the exposure in the usual manner. On development it will be found that the landscape slide has acted as a mask, and that the clouds appear in proper position on the lantern-slide plate.

947. After both negatives are dry they should be bound together. If, for any reason, the lower part of the cloud slide is affected by the light, this portion should be reduced with Ferricyanide. In other words, the landscape part of the cloud slide should be clear glass and the sky part of the landscape slide should also be clear glass. Then, on bringing the two together a brilliant combination cloud and landscape slide will be obtained.

948. **Cloud and Landscape on Same Slide by Contact.**—If it is desired to print the cloud and landscape portions on one slide, place the landscape negative in the printing-frame, first having made a mask as previously described. Expose the landscape portion, holding back the sky by using the mask. Now, remove the landscape negative and insert the cloud negative, placing the slide in proper position, which position should have been ascertained before starting to print. When making the exposure of the cloud portion, the landscape part of the sky should be protected from the

light by using the mask. With a little experience it will be possible to give uniform exposures and secure excellent results by this latter method; although, as is the case in making slides by reduction, the beginner will meet with better results if he employs the "cover-glass" method. Should the landscape or the sky part of the combination slide be too dark, its density may be reduced by using a Ferricyanide reducer.

CHAPTER XLIV.

Binding Lantern-Slides.

949. **Preparing the Cover-glass.**—When the slides are thoroughly dry they are ready for mounting (or binding), and should be provided with cover-glasses, to protect them from scratching. Before covering they must be suitably masked and also spotted. These cover-glasses are merely plain pieces of thin glass, the exact size of the lantern-slide, $3\frac{1}{4} \times 4$ inches. They are known as lantern-slide cover-glasses, and are furnished in one dozen or gross packages. For the first experiments it will not be necessary to purchase cover-glasses, but use spoiled lantern-plates in their place, as, naturally, some of the plates which are exposed will not be worthy of being bound or covered at all, and those plates may then be used for cover-glasses, after removing the film. *To remove the film from the plate* first soak the plate in cold water for an hour or two, and then change to hot water. This treatment will remove the entire film from the glass; then a slight scrubbing with warm water, soap, and a nail-brush, followed by rinsing in cold water, will give you cover-glasses ready for use.

950. A good plan, after the plates have been thoroughly washed in soap and water, is to place them for a few minutes in a bath of Acetic Acid, and then thoroughly rinse with water.

951. **Masking.**—The mask, or mat, as it is sometimes called, should be made of some thin, strong opaque paper. The best is black needle paper, which is tough and thin. Regular masks can be purchased with openings of any shape desired. (See Illustration No. 21.) If you wish to make the masks, cut the paper the size of the plate, $3\frac{1}{4} \times 4$ inches;

then cut out of the center the size and shape the view requires.

952. Write on one side of the paper mask, with white

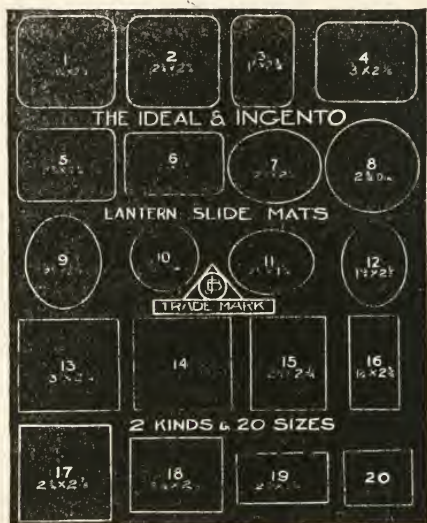


Illustration No. 21
See Paragraph No. 951

ink, the title of the slide, or any information regarding the scene. Do this writing in the upper portion, where it can be referred to when exhibiting. Fit the mask to the film as desired. When the slide is bound, apply a small gum sticker to the lower right-hand corner of the cover-glass, where it is used for numbering the slide. It also serves as a guide for inserting in the lantern, because when placing it in the lantern the slide is inserted top side down, with the white sticker at the top left-hand corner. This sticker indicates to the operator of the lantern the right way of inserting the

slide—always inserting it with the white sticker at the upper left-hand corner facing the screen.

953. The Ideal Mat is made of superior paper, which is especially manufactured for this purpose, the specific qualities being its water-proof finish, opaqueness and toughness. It is a solid black throughout, and a neat silver design is printed on one side. Another very good mat is the *Ingento* made of opaque paper, black on face, unprinted, and white on the back.

954. Both styles of mats are cut with the greatest accuracy, each opening being exactly in the center, cleanly cut, and devoid of ragged edges. All square openings are

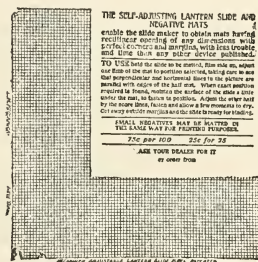


Illustration No. 22
McCormick's Lantern-Slide Mats
See Paragraph No. 955

uniform in size, both in height and width, a feature which is greatly appreciated by all operators. These mats are manufactured in twenty different shapes and sizes of openings.

955. McCormick's Self-Adjusting Lantern-Slide Mat.—For matting lantern-slides the Oberg Camera Co.'s (N. Y.) McCormick "Self-Adjusting" is the most perfect mat made. With it one can compose perfectly the scene on the lantern-slide, and then have the slide matted accordingly. As will be seen on referring to Illustration No. 32, the mats are L-shaped, two of them being required to mat one slide.

The slide-maker can obtain rectangular openings of any dimension on his slides, with perfect corners and margins, and with infinitely less time and trouble than with any other device on the market. Full directions come with each pad of mats. Assuming the perpendicular and horizontal lines of the picture are paralld with the edges of the plate, one section of the mat is placed in contact with the film (the film side of the plate being held away from you), paralleling the inner edges of the mat with the edges of the slide. When the exact position required is obtained, moisten the surface of the slide a little, under the mat, to fasten in position. Adjust the other half by the score lines. Fasten as above, then cut away outside margins, when the slide is ready for binding. Small negatives may be matted for printing purposes, in the same manner, with these mats.

956. **Mounting.**—Having the mask complete, lay the

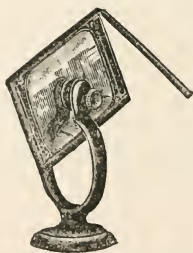


Illustration No. 23
Ideal Lantern-Slide Vise
See Paragraph No. 961

transparency plate, film side up, on a clean and flat surface. Next place the mat in position, and on this place the cover-glass. Care must be exercised that no dust or lint be bound up between the two glasses. After placing the mask and cover-glass in position, bind them together firmly with adhesive strips on all four ends.

957. In placing the cover-glass over the slide, the transparency and cover-glass must curve the same way, thus



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allowing them to be bound tightly together without breaking. The difficulty is to make the binding strips, or adhesive paper, adhere smoothly and firmly, but after a little practice and experimenting with two plain pieces of glass the proper way is acquired. This gummed strip should be thoroughly moistened with a damp sponge and made quite limp, to work to the best advantage, and must be watched closely while drying, to avoid wrinkles. *Keep all parts in contact.*

958. When prepared masks are used, the mask must be carefully adjusted until the opening is exactly where it is required, and then the mask is prevented from shifting by slightly moistening the surface of the slide under the mat. When this is dry, any part of the mask which projects beyond the slide may be trimmed off with a pair of scissors, and the slide is then ready for binding.

959. It is often possible to improve a commercial mask for some particular subjects, by sticking a strip of binder across it so as to narrow the opening; or, two masks may be crossed, one with the opening vertical and the other horizontal.

960. The secret in making a lantern-slide—as in trimming a print—is to adjust the shape and size opening to suit the subject, and give a good balance to the picture.

961. In Illustration No. 23 is presented a very ingenious little instrument, called the Ideal Lantern-slide Vise. By the use of this vise the mat is held in close con-



Illustration No. 24
The Ideal Binding Strips
See Paragraph No. 964

tact with the lantern-slide and cover glass, leaving both hands free to manipulate the binding strip. When the slide is clamped between the rubber discs, it may be revolved to facilitate the operation of binding.

962. The tape is applied by starting at one corner, tacking the corner securely, then continuing all the way

around, to the corner started from. Do not overlap the tape, as the overlap may add sufficient thickness to the slide to interfere with its working in the machine.

963. Where the slides are mounted by hand (without the vice), it is best to bind the two opposite edges first, and allow them to dry before binding the remaining two edges. The cutting of the corners should be exact, so there will be no overlap.

964. **Binding Strips.**—Binding strips are manufactured in two grades. The best grade is made of book-

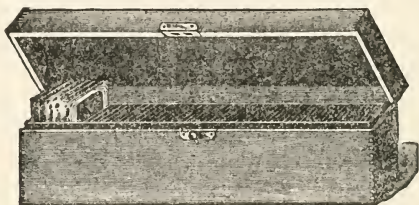


Illustration No. 25
Box for Lantern-Slides
See Paragraph No. 965

binders' black cloth, which is highly recommended on account of its everlasting qualities. The other grade is made of extra tough black paper and has been on the market for years. These strips are coated on one side with a special gum, which is the strongest adhesive known. They are cut the exact size for the standard lantern-slide, and packed neatly in long cardboard boxes. (See Illustration No. 24.)

965. **Caring for the Finished Lantern-Slide.**—The lantern-slides, after binding, should be placed in boxes especially built for this purpose. The ordinary lantern-slide box is made of wood. Cardboard partitions separate the slides to insure safety, at the same time offering great compactness. (See Illustration No. 25.)

966. These boxes will keep the plates free from dust, and at the same time prevent their becoming scratched or broken.

CHAPTER XLV.

Difficulties—Lantern-Slide Making.

967. Copying Prints for Lantern-Slides.—Carefully follow the instructions given in the lesson on copying, and strive to produce negatives that are crisp, not flat. Negatives must have a trifle more contrast than ordinarily. Use a little Bromide in the developer, so as to produce clear shadows and snappy high-lights, and develop to good strength. Be careful to overcome as much as possible the grain of the original picture being copied. Remember that from a flat, weak picture a snappy, brilliant slide can not be produced, but by accurate exposure and restrained developer the contrast of the original may be improved.

968. Developing Negatives to the Proper Strength.—Develop the negatives according to the exposure. If it is slightly over-exposed, treat it as such, and aim to produce snappy, brilliant negatives, slightly over-developed.

969. Results Flat When Making Lantern-Slide from a Large Negative.—Simply follow the instructions for excluding all light other than that which is admitted through the negative to be copied and there will be no trouble in overcoming this difficulty.

970. Focusing.—It is absolutely necessary that the image be extremely sharp; therefore use a magnifying-glass to examine the image on the ground-glass, and get it as sharp as possible, if necessary introducing a smaller stop to produce absolute sharpness.

971. Judging Correct Exposure.—Only practice and close observation can teach this. With a few experiments, noting carefully the conditions of light, etc., this difficulty will soon be overcome. It is advisable to use a test plate, giving portions of the plate different lengths of exposure. Then develop the plate and one portion should be found very nearly correct, sufficiently so to guide in the final exposure.

972. Obtaining Correct Size of Image on Lantern-Slide when Making Slide by Reduction.—Remember that placing the camera nearer to the negative will produce a larger image, and further away, a smaller one. With a little practice, the camera can always be placed so as to produce the proper size image.

973. Judging Proper Development.—Only practice and close observation can teach this. The experience had in developing ordinary plates should help to overcome this difficulty. It is almost impossible to state just how long or how far it must be developed. Remember that lantern plates must not be as hard and strong as negatives. Develop only until full detail and fair crispness are obtained, then the plate is fully developed.

974. Uneven Color of Lantern-Slides.—Uneven development, or using a plain Hypo bath, is apt to cause this difficulty. The remedy is obvious.

975. No Snap or Contrast in Slide.—This is almost a certain sign that it is over-printed or over-exposed. Be careful about this and treat the slide according to the exposure. If over-exposed, add more Bromide to the developer. It is better to have the slide a trifle under than over-exposed.

976. Slide too Contrasty.—Much under-exposure or an excessive amount of Bromide will cause contrasty slides.

977. Slides Weak and Gray.—This is a certain sign that the slide was either under-developed or over-exposed, and that the slide, in development, was not treated according to the exposure. Aim for accurate exposure and if the plate shows signs of over-exposure add a few drops of Bromide to the bath.

978. White Part of Slide not Clear.—Again a sign that the slide was over-exposed and not treated according to the exposure, therefore a fogging of the whites is produced.

979. Overcoming Over-Exposure by Reduction.—An over-exposed but fully developed slide, or one over-developed, can often be made into a good slide by immersing it, after fixation, in a weak bath of Ferricyanide of Potassium, stopping the reduction when the desired clearness is gained.

980. Local Reduction.—Slides that are too dense in parts can be locally reduced by the application of a weak solution of Ferricyanide of Potassium to the parts to be reduced. Many expert slide-makers prefer to over-develop their plates and then reduce down to the desired density by using a Ferricyanide bath. (For method of Reducing, see Volume II.)

981. Grain in Film.—Under-exposure and prolonged development will frequently produce grain. If the lantern-slide has been made from a copy, the grain may have been caused by the grain in the original picture. Extremely slow drying of the lantern-slide will also cause grain. Drying too fast will sometimes cause grain. Be careful that the plates are thoroughly washed in clear water, and if the water is dirty see that each slide, before it is set up to dry, is swabbed with a piece of absorbent cotton which has been thoroughly saturated with clear water. Dry the slides

in a well ventilated room, where there is plenty of air and not too much heat. Dry with a fan when possible, but do not have the fan too close to the negatives.

982. Unable to Produce a Brown Tone.—Carefully follow the instructions and prepare the developer according to the formula given for this purpose; give the proper exposure, and you will have no trouble in overcoming this difficulty.

983. Difficulty in Properly Placing the Cover-Glass over the Slide.—Carefully examine the slide, holding it up and looking over the surface of the glass, and observe which way the slide and cover-glass curve. Then place the slide and cover-glass in contact, so that both curve in the same way. The remedies for difficulties encountered in the developing of ordinary dry plates can also be applied to the development of lantern-slides. For further information on Developing, see Vol. II.

CHAPTER XLVI.

Lantern-Slides—Pointers.

984. **Rinsing.**—Always rinse slide between development and fixing.

985. **Dusting.**—Remember that both negative and lantern-plate must be carefully dusted before exposing, when making a contact slide.

986. **When to Stop Development.**—Development for black tones should be carried on until the high-lights begin to cloud. If the slide has been correctly exposed this will give the correct density.

987. **Black Tones.**—Short exposure and quick development give black tones.

988. **Applying Developer.**—Always pour the developer directly on the plate without previously soaking in water.

989. **Thin Slides.**—Thin slides are generally caused by under-development.

990. **Flat Slides.**—If the image comes up too quickly in the developer, the resulting slide will be flat and lacking in contrast.

991. **Warm Tones.**—Prolonged exposure and restrained developer give warm tones.

992. **Varnishing the Binding.**—The binding of a lantern-slide may be protected by painting over with shellac varnish.

993. **Warm Slides Before Mounting.**—Slides should be warmed slightly, so that they will be thoroughly dry before mounting and binding.

994. **Slides from Flat Negatives.**—Plucky slides can be obtained from thin or flat negatives by using slow plates,

slightly under-exposing, and using a diluted developer.

995. **Developing Light.**—Rapid lantern-slide plates can be manipulated in yellow light; a thickness or two of yellow post-office paper is sufficient.

996. **Sorting Negatives.**—Remember that a great deal of time is saved when making a large number of slides, by sorting your negatives into batches of approximately similar density.

997. **Slides from Hard Negatives.**—Slides made from hard, contrasty negatives, should be slightly over-exposed and developed quickly.

998. **Pin-holes.**—Pin-holes can be touched out in lantern-slides with a sharp pointed pencil, holding the pencil in a vertical position, with a dotting action.

999. **Making White Ink.**—White ink for writing on slides can be made by mixing artist's zinc-white with water. About 60 grains of gum arabic should be added to every ounce.

1000. **Reducing.**—To reduce over-developed slides, take two ounces of 10% solution of Hypo and add 10 drops of saturated solution of Red Prussiate of Potash (Potassium Ferricyanide). Place the slide directly in this immediately after coming from the Hypo, and watch the reducing carefully. Remove as soon as reduced sufficiently, rinse, and return to the Hypo for five minutes.

1001. **Slide Over-Exposed.**—When a slide is over-printed, by the time the high-lights are sufficiently strong the shadows will have become too dense or clogged. If, on the other hand, the shadows have not attained sufficient density, when the high-lights have their proper strength, and the shadows appear veiled, rest assured that the slide has been over-exposed.

1002. **Wash Thoroughly.**—Lantern-slides must be thoroughly free from Hypo or trouble will arise.

1003. **Developing in Cold Weather.**—In cold weather it is advisable to warm the developing tray by pouring hot water into it before development.

1004. **Sulphide Toning.**—The sulphide method of ton-

ing Bromide paper can also be applied to lantern-slides with very good results.

1005. **Storing Slides.**—Lantern-slides should be stored in a warm, dry place; otherwise they are apt to absorb moisture.

1006. **Distinguishing Film Side.**—The emulsion on a lantern-slide plate being very thin and very glossy, it is sometimes hard for the beginner to distinguish the glass side from the film side. By breathing on both sides of the plate it will be no trouble to judge correctly. The glass side will become dulled by the moisture, but the film side will show no change.

CHAPTER XLVII.

Coloring Lantern-Slides.

1007. **Introduction.**—The coloring of lantern-slides is not a difficult task, but it is necessary that they be handled with great care, as the film is very delicate and easily spoiled. There are many different makes of colors on the market. The most popular in use are the Japanese Water Colors and Dunne Transparent Pastel Colors. A box containing twelve tubes will be sufficient to color several dozen slides, and can be secured at any art store. Some of the desirable colors for slides are Rose-Madder, Gold, Ruby-Red, Purple, Ivory-Black, Silver-Gray, Flesh, Cobalt-Blue, Lemon-Yellow, Gray-Green, Sepia and Emerald-Green.

1008. The tubes should never be left uncorked. The best brushes are either the Russian or Red Sable oil brushes Nos. 1, 5, 7 and 10. Cut the handles short enough to fit into a large box of colors. Use No. 1 for all detail work, No. 7 for warm colors, No. 5 and No. 10 for dark ones. Never attempt to use flimsy brushes as they cannot carry the color with them fast enough to keep from spotting. Cleanse them well before using the different colors, and before putting them back in the box.

1009. Before beginning the work place three or four thicknesses of newspaper on the table, to test the colors and wipe the brushes on, tearing it off as it becomes soiled. A very convenient accessory to this work is a china palette having a number of recesses in it. These palettes are made with 4, 6 and up to 21 recesses. The six recess palette, however, will answer very well and is not as expensive, of course, as the larger ones. Colors can be left over in these recesses, provided they are protected from the dust. The

larger pallettes are quite valuable, as they facilitate the mixing of colors more economically.

1010. If it is not convenient to purchase one of these china pallettes, use a common piece of glass, previously well cleaned. Place the pallette or sheet of glass (about 8 x 10 inches in size) on the newspaper, together with two small cups of clear water, one for diluting the colors (which must be kept clean) and the other for washing the brushes. If the brushes are washed while using them, wipe the water thoroughly out of them each time on the newspaper or the color will be made too weak to use.

1011. When opening the tubes catch the fold at the lower end of tube between the thumb and first finger. Unscrew the top and squeeze the tube lightly, discharging not more than one drop of the color, except when coloring dark shades; then colors must be used stronger. If the top will not unscrew pass a small knife blade around the base of the cap—this will release it. Keep the tubes clean at the top and no difficulty will be experienced on account of the cap sticking.

1012. **Mixing Colors.**—To mix or dilute any color, first discharge a drop of the color on the slab; then charge the brush with clear water, drop it onto the color and mix with this brush. If the color is too strong, dilute by again charging the brush with water—that is, dipping it in the cup of water and dropping onto the color.

1013. Where a combination of colors is to be prepared, discharge one drop of each of the colors on a separate space on the slab; combine the colors in another space by dipping the brush in each color and carrying it to the one space, then diluting the combination of colors with water in the same manner as a single color

1014. **Coloring Portrait Slides.**—In the first recess on the left of the pallette or to the extreme left of the sheet of glass, place a drop of *flesh* color and dilute with a couple drops of water. Next to this put another drop of *flesh* color and dilute with four to six drops of water, for all flesh washes. Next to this put some of the stronger di-



STUDY No. 18 "THE WANDERING MUSICIANS"

F. REIME



luted *flesh* tint from the first recess, mixing a touch of *sepia* with it, to make a warm brown for tinting the shadows in all flesh parts of the portrait (when these shadows are extremely dark add a tiny bit of yellow); next to this shadow tint put *sepia*, which is to be used for hair tints or any extra tints needed. Next, *cobalt-blue* diluted very little; then *cobalt-blue* diluted weak for all pale blues; next *ivory-black* diluted very little; next a very little *ivory-black* diluted weak for outlining the detail work, such as dotting out embroidery and lace.

1015. A drop of *rose-madder*, *gold*, *lemon-yellow* and *grey-green* should be placed separately on the glass, with space between each color to allow of sufficient room to dilute when necessary. It is very important that the palette or glass be used systematically, for it saves time and material; also avoids the risk of getting your colors mixed.

1016. **Applying the Colors.**—Before applying any colors the whole surface of the plate should be moistened with clean water. Holding the slide with the head toward you, with a large brush well filled with water, moisten the whole surface of the plate. Work up the background first. Take the medium sized brush, moderately charged with weak color, and wash the background evenly in long strokes. Continue applying the weak color until the correct density and shade are obtained. Wash over large spaces as quickly as possible, so they will not be streaked or spotted. If difficulty should be experienced along this line, reduce by applying, with the brush, water or 95% alcohol.

1017. The light side of the background must be colored with light colors made extremely weak, going over it several times to secure the desired shade. Cobalt-Blue, Grey-Green, Silver-Grey, Gold and very light colors are nice for this, using harmonizing dark shades for the dark side of the background.

1018. In cloud effects, *cobalt-blue* in the high-lights and *red-brown* in the shadows give a beautiful effect. Colors must be used stronger in the shadows. To tint the face use the *flesh* and *shadow* tints mixed as previously directed.

Having very little in the brush, proceed to color all shadows in the flesh parts of the slide. This gives a round effect to the face, arms, fingers, etc., though great care must be exercised not to get too much onto the slide. After having tinted the shadows, wash over the entire flesh with weak *flesh* color, beginning in the shadows. Several applications may be used until the desired shade has been secured. This color, however, should be extremely weak, and if repeated applications do not give the desired result, make the solution a little stronger.

1019. Color the cheeks with *ruby-red*, charging the brush very lightly. Wipe nearly all of the color out of the brush onto a newspaper, before touching the cheeks. The color must be used on the dark side of the face. Use the same color much stronger for the lips, applying it with a No. 1 brush. Use the *ivory-black* strong, with a No. 1 brush, for eyebrows and lashes, and very weak for outlining and such detailed work as dotting-out lace and embroidery. Use *cobalt-blue* strong for dark blue eyes and very weak for grey eyes. Strong *sepia* for brown eyes and weak for hazel. Put the pupil in with strong *ivory-black*. Color the shadows in dark hair with rather strong *ivory-black* and with very weak color in light hair; then wash over with whatever tint is desired. Those who cannot mix the colors will find all hair tints in the list of extra tubes given on the circulars, which accompany the colors.

1020. Draperies, flowers, ribbons, etc., should be given the desired shade first, strengthening the shadows afterward with the same shade made stronger. Light articles must be tinted with extremely weak color, and dark with rather strong colors.

1021. **Coloring Landscapes.**—After moistening the plate with clean water, color the sky first, holding the slide upside down. Begin near the horizon with extremely weak *cobalt-blue*, *Italian sky-blue* or *crulean-blue* and wash the color towards you over the entire sky and any trees that may extend over into the sky. Make the sky at the top of the slide much deeper blue and graduate it down to about the

center. It is better to put on several applications with weak color than to apply a strong color and spoil the slide. If a sun-set effect is desired, use the sun-set tint very weak while the sky is moist. If clouds appear, color between them with *blue*, leaving the white clouds white. If it is a sun-set view, some clouds should be very faintly tinted on the edges, with the sun-set tint, *yellow* or *gold*. Dark clouds may be colored with *silver-grey*, *red-brown* or *fawn*. A plain white sky may be clouded by applying color in different places with *cobalt-blue*, very weak.

1022. **Trees.**—Trees which appear in the extreme distance should be colored with weak *silver-grey*, those next with weak *grey-green*; next with very weak *olive-green*. For distant fields use *bronze-green* in the high-lights and *olive-green* in the shadows. *Alizarine-green* is nice for distant fields, or weak *olive-green* may be used. Where several trees appear in the picture, they should each be colored with a different shade of green. Those nearest in the foreground, if of very dark color, with *Hunter's-green* in the high-lights, and *red-brown* in the shadows; others with *olive-green* in lights, and *Hunter's-green* in shadow. If the trees are light, color one with *bronze-green* in the high-lights, and *Hunter's-green* in the shadows; another with *apple-green*; another with *Alizarine-green*. This will give a beautiful variety of greens. Grass may be colored also with these different greens, the *red-brown* being void in some of the shadows.

1023. **Mountains and Rocks.**—Mountains in extreme distances may be colored with either very weak *silver-grey*, or weak *purple*, nearer ones with weak *grey-green*, and those still nearer with *olive-green*, shaded in places with *red-brown* and *burnt-sienna*. Always make the colors extremely weak in the far distance and stronger in the foreground. Use *silver-grey* strong in shadows of natural stone, and very weak in high-lights. Rocks may be colored with *silver-grey*, *burnt-sienna*, *golden-brown*, *sepia*, *fawn* or *tan* colors; or *red-brown* rock tint in the shadows, with *bronze-gold* in the high-lights, which gives the prettiest effect where rocks are near green foliage. Use *brick* color for chimneys.

1024. **Water.**—Color very light water with weak *cobalt-blue*. For very dark water, use *Hunter's-green* in the shadows, and *bluc-green* in the high-lights. The ocean may be colored with these, shading some waves into *olive-green*, leaving the white-caps white. All colors mentioned can be obtained in extra tubes, if you should not care to mix them.

1025. **Important.**—For all lantern-slide work, the strongest and most brilliant colors are not only desirable, but necessary, and it is important that the very best make of colors be secured, for the strong light of the lantern will fade them after they have been in use for some time, if the colors are not sufficiently pure to withstand the action of the light.

1026. Be very careful to keep the dust off the slide while it is moist, and when colored, place it in a negative rack, or, lay it film side down to dry, *one end slightly elevated so that nothing will touch the film*.

1027. A white card, laid back of the slide while coloring, will show small details perfectly.

1028. Follow these directions as carefully as possible. It is best to experiment with half a dozen slides, which are not particularly valuable, before venturing upon something of more worth.

CHAPTER XLVIII.

Part I

Method of Enlarging.

By Wm. H. Phillips.

The following is a memorandum of my equipment:

1029. I use a No. 3 Folding Pocket kodak, fitted with a Goerz lens, 5 inch focus. I use N. C. films for my negatives, and develop with a developing machine. I use Pyro powders for developer. The paper I use for enlarging is Royal Bromide, developed with Rodinal (no Bromide).

1030. I make all my enlargements by daylight, in a room containing one window, fitted similar to the illustrations shown in this volume. For an easel, however, I use a regular printing-frame; placing my Bromide paper in the printing-frame, with the back clamped on firmly. This holds my paper perfectly flat. I place the printing-frame upon a box, and, in order to hold the printing-frame perpendicularly, I place another small box back of it. The printing-frame is stood on edge upon the large box, and placed on a line with, and directly in front of, the enlarging camera, the latter being arranged in the window. The box containing the printing-frame, or, in short, my easel, is moved backward and forward, to or from the camera until the desired size and focus is obtained.

1031. **Variations.**—I sometimes use silk bolting-cloth placed in contact with the paper, or at some distance from it, according to the diffusion desired. This is a matter of one's own judgment, and depends upon the subject and negative used.

1032. **Exposure.**—The exposure given varies from 1 to 20 seconds. I invariably use test strips before exposing a full sheet, and these strips are the full length of the size sheet I expect to use, and placed diagonally in the printing-frame. The test is taken by exposing the paper in sections, using an ordinary card before the exposed paper. The first section is exposed 5 seconds; then I move the card over a little farther and give another 5 seconds exposure, and so on until I have five exposures on this strip, one of which will have 25 seconds; another exposure 20 seconds; a third, 15 seconds; a fourth, 10 seconds, and the last, 5 seconds. This test strip is then developed, and the exposure on the section giving the best results is the amount of exposure I use for my final exposing from this negative. I use Rodinal without Bromide entirely, for my developer.

Part II.

Method of Enlarging.

By George H. Scheer, M. D.

1033. My apparatus is the simplest imaginable. I use one of the rooms in my office for making Bromide enlargements. This room has only one window, which faces south. This window I cover with a screen made of a light frame-work of pine, covered on one side with green shade-cloth, on the other with rosin paper. Into the lower part of the screen is inserted a frame, into which is fitted a short wooden box or tube; the end of this tube which fits into the frame in the screen, has a flange, the outer side of which is covered with felt strips. This tube is held firmly against the frame by means of a couple of wooden cleats. The other end of the tube fits the back of my camera when the focusing screen is removed, and is held against the camera by means of stout rubber bands and a couple of picture hooks. A portion of the board forming

the upper side of the tube is not nailed firmly down, but is hinged, so that the board near the opening in the screen can be raised for inserting the negative into slots on the inner sides of the tube or box. Negatives can then be easily removed and inserted.

1034. I use my regular camera and lens for all my enlarging. The lens is an Extra Rapid Manhattan Symmetrical (5×7) which I have had for about 10 or 11 years. I always use the lens wide open (it works at *f.* 8).

1035. To diffuse and equalize the light I use several sheets of white tissue paper, one pasted to the window-pane, the other to the outer side of the screen-opening.

1036. For an easel I use a flat box placed on end. One side of this box is covered with white paper upon which I have marked, with heavy black lines, the outline of the different sizes of sheets of Bromide I use, $6\frac{1}{2} \times 8\frac{1}{2}$, 8×10 , 11×14 , etc. The box is placed upon a small table and both box and table can be readily moved backward and forward as necessary.

1037. Having placed the screen in the window and adjusted the wooden tube to the screen and the camera to the tube, I insert my negative into the slots (near the screen end of the tube), put down the hinged cover, cover the whole with a focusing cloth, open the shutter and rack the bellows in or out until I get a sharp image upon the white paper which covers the box used as an easel. If the image on this focusing screen is larger than I want, I move the box closer to the camera and rack out the bellows until I have my image of just the proper size and sharpness. I then close my shutter, place the ruby lantern on top of the camera, and pin the Bromide paper upon the place marked out for that particular size. With the shutter set for time exposures I press the bulb and make my exposure, counting the seconds by estimate. I never use test strips, as I can judge from experience the proper exposure under almost any condition of light.

1038. If any part of the negative needs less exposure than the remainder it can be shaded by means of a piece of

cardboard interposed between the lens and paper. To prevent sharp lines in the print the cardboard, of course, should be kept moving while the exposure is being made. When the right exposure has been given a squeeze of the bulb closes the shutter. The paper is removed from the board and immersed in the developer which is ready in a large tray on a wooden bench near by. I do not wet my paper before placing it into the developer, but care must be taken to flood the developer over the paper quickly and evenly by vigorous rocking of the tray. For developing I use M. Q., making it up myself from the formula furnished by the manufacturer. I use only C. P. desiccated sodas.

1039. When the print is fully developed I take it out and slush it a couple of times through clear water in a tray, and then place it in the hypo bath. I use plain hypo bath of the strength recommended by the makers of the particular paper I am using. The prints should be vigorously moved for a minute or two after being placed in the hypo bath. I grasp the print by the two corners of one end and slush it through the fixer 6 to 10 times, the purpose of this being to wash off any traces of the developing solution which may be left on the film, such places where the developer still clings to the film turning yellow or brown, in the fixing bath, by oxidization. After sufficient fixing the prints need only be washed and hung up to dry.

1040. As you will see from the above, I employ only daylight for enlarging and use no condensers at all.

1041. To obtain sepia tones I bleach the prints (after thorough fixing and washing) in a solution of Red Prussiate of Potassium and Potassium Bromide, using a little more of the latter than of the former. The exact strength of this bleaching bath does not matter, but of course a strong bath works much more rapidly than a weaker one. Personally I prefer quite a weak solution, as its working is more easily controlled. It is not at all necessary to bleach the print entirely; stronger, more vigorous browns will result if the bleaching is only partial. In some instances very pleasing double tones may be obtained by only

very slight bleaching. The exact amount of bleaching which gives the best results must be determined by experiment.

1042. After sufficiently bleached, the prints are rinsed in clear water and put into a solution of *Sulphide* of Soda in water, when they will at once turn darker and darker until a brown tone is reached. The strength of the Sodium Sulphide solution is immaterial, but only a very weak solution need be employed; a crystal the size of a hazel nut will tone a dozen or two large prints.

1043. The color of the finished print is not dependent to any great extent upon the method of using this process; it is really determined by the exposure and development of the paper. A print which has been over-exposed and therefore had to be given only short development will come out of the re-developing process with a sickly yellowish-brown hue. A print, on the other hand, which has had only a short exposure and prolonged development will, after re-development, have a dark-brown, chocolate or almost purplish tone.

1044. Over-exposure is particularly to be avoided where the prints are intended to be re-developed. This, I think, explains my method fully.

CHAPTER XLIX.

How the Studies Illustrating this Volume Were Made.

Study No. 1. By Miss Katherine Bingham, St. Johnsbury, Vt. Title, "Responsibility." This negative was made in an old jail in York, Me., built in 1654. The exposure was made on a clear day at 2 P. M.; stop used, U. S. 4; plate used, Cramer Medium Isochromatic; exposure given, 5 seconds; developed with Pyro-acetone. The negative after development was reduced with Persulphate of Ammonia. Print was made on Willis & Clements' CC Platinum, mounted on salmon-colored cardboard. (See Frontispiece.)

Study No. 2. By H. B. Conyers, Urbana, Ohio. Title, "A Mashed Finger." This picture was made in the month of May with weather bright, and was made in the home with a light from a small window. The lens used was a $3\frac{1}{4} \times 4\frac{1}{4}$ Tessar, fitted to a kodak, and the negative was enlarged on Royal Bromide, mounted on deep cream mount. (See Page 31.)

Study No. 3. By John S. Neary, Trenton, N. J. Title, "Day After Election." This picture was taken at 4 P. M., on the shady side of a hut. The camera used was a Premo 5×7 , fitted with Goerz lens; the plate was developed with Pyro; no after treatment. (See Page 53.)

Study No. 4. By Eva Godley Rolfe, Washington, D. C. Subject, "Serious Meditation." This picture was made in the home, on the afternoon of a clear day. The lens used was a Rapid Rectigraph; 8-inch focus; stop used, wide open; plate used, Seed 26-X; developed in Pyro, with no after manipula-

tion; printing process, Willis & Clements' Sepia; triple combination mount—first cream, followed with a salmon-color, and finally with cream mount. (See Page 67.)

Study No. 5. By Miss Cora Stanwood Cobb, Boston, Mass. Title, "Little Æolus." This picture was made about noon on a bright July day. The lens used was a Bausch & Lomb Double Anastigmat; stop used, f. 4; plate used, Seed 26-X; exposure given 1-25 of a second; plate developed with Pyro; print was made on Velox. (See Page 81.)

Note (by the Editor). Miss Cora Stanwood Cobb is the daughter of Darius Cobb the artist. She is an enthusiastic amateur and tries to exemplify by her camera her father's theory that photography is one of the fine arts.

Study No. 6. By Mrs. W. W. Pearce, Muskegon, Ill. Title, "Chums." The exposure was made on a bright sunny day; lens used was a Bausch & Lomb Rapid Rectilinear; stop used, f. 8; plate used, Cramer Crown; exposure given, 1-25 second; developed in Pyro; printing process, enlargement made on Royal Bromide from a 5 x 7 plate. (See Page 105).

Study No. 7. By Mrs. Nancy Ford Cones, Covington, Ky. Title, "Mother and Child." The exposure was made in the home at 12:30 P. M., on a fair day; lens used, Bausch & Lomb Rapid Rectilinear; stop used, U. S. 4; exposure given, 2 seconds. Negative was made on Eastman Non-Curling film and developed with Metol-Hydroquinon. The print was made on Aristo-platino paper, sepia tone, mounted on warm sepia mount. (See Page 133.)

Study No. 8. By Mathilde Weil, Philadelphia, Pa. Outdoor portrait. This picture was made out of doors on a 6½ x 8½ plate with a lens of 12 inch focus, used at f. 8, its widest opening. Seed 27 Gilt-Edge plate was used and developed in Metol-Hydroquinon developer. The print was made on Japanese tissue, sepia tone, mounted triple combination—first white, second Nile-green, third, deckled tissue over dark strawboard; final mount, light strawboard. (See Page 183.)

Study No. 9. By Mrs. Nancy Ford Cones, Covington,

Ky. Subject, "Knitting." The exposure was made in the home at 2 P. M., weather conditions bright. The lens used was a Bausch & Lomb Rapid Rectilinear; stop used, U. S. 4; exposure given, 5 seconds; plate used, Cramer Banner, developed with Metol-Hydroquinon; printing process, Aristo-platino, sepia tone, mounted on sepia mount. (See Page 199.)

Study No. 10. By Mrs. Nancy Ford Cones, Covington, Ky. Subject, "The Splinter." The exposure was made at 11 A. M., on a cloudy day; lens used, Bausch & Lomb Rapid Rectilinear; stop used, U. S. 32; exposure given, 2 seconds; negative was made on Eastman Non-Curling film, developed with Metol-Hydroquinon; printing process, Aristo-platino, sepia tone, mounted on sepia mount. (See Page 217.)

Study No. 11. By Wm. H. Phillips, Liverpool, Ohio. Title, "East is East, and West is West." Camera used, No. 3 Pocket Folding Kodak; lens used Goerz Series III, 5 inch focus. The negative was made on Non-Curling film, developed with Pyro. The print is a Bromide enlargement made on Royal Bromide, developed in Rodinal strong solution—one part Rodinal, 6 parts water. (See Page 243.)

Study No. 12. By H. B. Conyers, Urbana, Ohio. Title, "The Last Sheaf." The exposure was made on an August day in the afternoon, with very dull light. The lens used was a Tessar fitted to a $3\frac{1}{4} \times 4\frac{1}{4}$ kodak, used full open; exposure given, $\frac{1}{4}$ second. The print is an enlargement on Bromide paper and mounted on carbon-brown. (See Page 257.)

Study No. 13. By Will H. Walker, Portland, Oregon. Subject, "Marguerite." The picture was made on a bright June morning; exposure was made at 5:30 A. M.; lens used, Zeiss, No. 7; focal length, $8\frac{1}{2}$ inches; stop used, f. 8; exposure given, 1-5 second; plate used, Hammer Non-Halation; developer, Pyro, weak with no after manipulations; printing process, Aristo-platino. (See Page 277.)

Remarks. This picture was taken in the early hours of the morning to avoid interruption by passing people. The picture is mounted on a very warm sepia mount.

Study No. 14. By Alfred Holden, Philadelphia, Pa. The exposure was made in an ordinary sitting room, 9 x 12 ft.; style of light used, ordinary window with an open light; lens used, Voigtlander Collinear Series II, No. 5, focal length, 8½ inches; stop used, f. 6; exposure, 5 seconds; plate used, Cramer Crown, developed in Pyro-soda with no after manipulations; printing process, Artura Iris, toned in sepia; mounting, dark cream portrait, warm sepia tone. (See Page 287.)

Study No. 15. By Louis Fleckenstein, Los Angeles, Cal. "Lullaby." This picture was hung in the Fourth American Salon and was made in a room 8 x 12 feet, with an ordinary window facing east with a light full size of window and window was used open without curtains, and the shadow side illuminated with a mirror; lens used was a Smith Semi-Achromatic; focal length, 16 inches; stop used, f. 5; exposure given, 1 second; plate used, Lumiere Special Portrait; developed in Rodinal with no after manipulations; printing process, Engravers Black Autotype Carbon Tissue, printed from reverse side of negative. (See Page 305.)

Study No. 16. By Mrs. Myra Albert Wiggins, N. Yakima, Wash. Subject, "Polishing Brass." This picture was made with a north light near an ordinary window in my art studio. The exposure was made in the morning; lens used, Bausch & Lomb with an open stop; exposure given, 2 seconds; plate used, Seed, developed in Pyro with no after manipulations, printing process, Sepia Platinum, mounted on sepia-brown followed with salmon-color. (See Page 319.)

Study No. 17. By J. H. Field, Berlin, Wis. Subject, "Feeding the Goldfish." This picture was made in the home by an ordinary window, with bright sunlight; lens used, 8 x 10 Portrait; plate used, Seed 26-X; developer used, Pyro-soda; highest lights of the negative were slightly reduced after developing; print was made on Platinum paper. (See Page 329.)

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